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A. F. Tech. Instr. 25-103733

DRAFTED J. BOTTEM		B-13		DATE OF CHG 9-6-59		THE BOEING COMPANY ADVANCE DRAWING CHANGE NOTICE		ISSUE NO G		DRAWING NO 10-81000		EJECTION SEAT E SURVIVAL SYSTEM	
CHECKED P. P. P.		8/5/59		22-10-59		REASON TO PROVIDE THE PILOT A POSITIVE (POWERED ASSIST) MEANS OF ADJUSTING TILT BACK.		USED ON X-20		DRAWING NO 10-81000		EJECTION SEAT E SURVIVAL SYSTEM	
STRESS ANALYSIS C. H. H.		4/5/59		8/11/59		REASON TO PROVIDE THE PILOT A POSITIVE (POWERED ASSIST) MEANS OF ADJUSTING TILT BACK.		USED ON X-20		DRAWING NO 10-81000		EJECTION SEAT E SURVIVAL SYSTEM	
RELIABILITY APPROVAL P. P. P.		4/5/59		8/11/59		REASON TO PROVIDE THE PILOT A POSITIVE (POWERED ASSIST) MEANS OF ADJUSTING TILT BACK.		USED ON X-20		DRAWING NO 10-81000		EJECTION SEAT E SURVIVAL SYSTEM	
REQUESTED CUSTOMER		8/5/59		8/11/59		REASON TO PROVIDE THE PILOT A POSITIVE (POWERED ASSIST) MEANS OF ADJUSTING TILT BACK.		USED ON X-20		DRAWING NO 10-81000		EJECTION SEAT E SURVIVAL SYSTEM	
L-11 ZONE		RECD		PART NUMBER		DESCRIPTION		ZONE		STOCK SIZE		MAYL	
L-11 ZONE		RECD		PART NUMBER		DESCRIPTION		ZONE		STOCK SIZE		MAYL	
L-11 ZONE		RECD		PART NUMBER		DESCRIPTION		ZONE		STOCK SIZE		MAYL	

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PAGE 104 CHANGE PARAGRAPH 3.1.7 AS FOLLOWS:

" It shall not exceed 397.0 pounds - - - - "

PAGE 11 ADD PARAGRAPH AS FOLLOWS:

" 3.2.1.3 SEAT BACK TILT ANGLE ADJUSTMENT ACTUATOR. (10-81000-20 ONLY) A seat back tilt angle adjustment actuator shall be provided on the seat. This actuator shall be designed so that it will force the seat back forward under the full weight of a suited 75th percentile pilot in the boost position and under the force of a pressurized suit in the flight position. The actuator shall be wholly contained within the seat envelope and shall be hand-operated by the pilot with the suit pressurized or unpressurized. This actuator supplements the requirements of paragraph 3.2.1.2. "

PAGE 17 CHANGE PARAGRAPH 3.3.1 AS FOLLOWS:

" - - - - - weight of 397 pounds maximum - - - - - "

PAGE 205, CHANGE PARAGRAPH 4.4.2 AS FOLLOWS:

" - - - - - positioning requirements of paragraph 3.2.1 through 3.2.1.3. "

P SUPPLIER FURNISHED ITEM

NEXT ASSY		USED ON		SECT. NO		SERIAL NUMBER		PART NUMBER		REL COL IND		DRAWING SHEET NUMBER		NEXT ASSY		FINAL ASSY	

PAGE 10a - IN PARA. 3.1.6 MAKE THE FOLLOWING CHANGES: A) F₁ F₂ & F₃ + F₄

PAGE 9 - ADD:
"MIL-S-5002 SURFACE TREATMENT (EXCEPT PAINTING AND PRIMING)
FOR METAL AND METAL PARTS IN AIRCRAFT"

SUPPLIER FURNISHED ITEM

NEXT ASSY	UNDO ON	SECT. NO	SERIAL NUMBER	PART NUMBER	REL. COL. IND	DRAWING SHEET NUMBER	NEXT ASSY	FINAL ASSY
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APPLICATION								

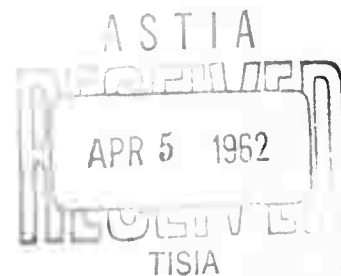
**THE BOEING COMPANY
AERO-SPACE DIVISION**
LETTER OF TRANSMITTAL AND SHIPMENT NOTICE

SHIPPED TO

Air Force Technical Agency
Arlington Hall Station
Arlington Hall, Virginia

DATE March 23, 1962
SHIPMENT NO. 25-158840
LETTER NO. _____
LETTER DATE _____
REFERENCE _____

One (1) copy of revision to Source Control Drawing 10-81000 "Dyna-Soar Ejection Seat and Survival System" dated March 16, 1962 (Unclassified)



EWT:kl

IMPORTANT

Sign and return white copy as acknowledgment of receipt of data.

Date received _____

By _____

RETURN ADDRESS

THE BOEING COMPANY
AERO-SPACE DIVISION
P.O. BOX 3707
SEATTLE 24, WASHINGTON

ATTN: Engineering Records M/S 11-98

DREV

35

REVISIONS

SYM	DESCRIPTION	DATE	APPROVAL
D	<p>(1) Changed seat back boost position angle from 3 degrees aft to 2 degrees forward and called for adjustable upper arm supports to conform. (2) Revised sled test requirements to call out specific responsibilities and requirements, including heat shield in Appendix B. (3) Made The Boeing Company responsible for the lower half of the tube-cutter electrical disconnect and the pressure switch tube disconnect. (4) Called out rail hole size and rail end chamfer. (5) Called for safety pin in harness release handle. (6) Clarified "D" ring position in Figure 8.</p> <p>Reason: (1) Customer requested new seat back angle for boost. (2) through (6) Completion of basic design and drawing clarification. BO-2-0046</p>	4/16/62	<p><i>R. Hyman</i></p> <p><i>Don</i> 8-19 <i>Feb</i> 3/16/62</p>

13/19/62
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CODE IDENT NO. 81205	SIZE A	10-81000
SCALE	AF 33(657)-7132	SH 2c

3219-6284-3-10-62

LIST OF ACTIVE PAGES AND CHANGE RECORD

[illegible]

TABLE OF CONTENTS

	<u>PAGE</u>
1.0 SCOPE	8
1.1 SCOPE	8
1.2 INTENDED USE AND ASSEMBLY BREAKDOWN	8
2.0 APPLICABLE DOCUMENTS	9
2.1 GOVERNMENT	9
2.2 NON-GOVERNMENT	9
3.0 REQUIREMENTS	10
3.1 GENERAL REQUIREMENTS	10
3.2 SYSTEM DESIGN	11
3.3 EJECTION SEAT AND SURVIVAL SYSTEM CONSTRUCTION	17
3.4 SYSTEM PERFORMANCE	18
4.0 QUALITY ASSURANCE PROVISIONS	20
4.1 GENERAL	20
4.2 QUALIFICATION (PRE-PRODUCTION) TESTS	20
4.3 ACCEPTANCE (FUNCTIONAL) TESTS	20a
4.4 TEST REQUIREMENTS	20a
5.0 PREPARATION FOR DELIVERY	22
6.0 NOTES	22
6.1 EJECTION SEAT INTERFACE	22
APPENDIX A DEVIATIONS TO MIL-S-9479, SEAT, UPWARD EJECTION, AIRCRAFT	32 - 34
APPENDIX B HEAT SHIELD SLED TEST REQUIREMENTS	35

4
DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

THE BOEING COMPANY

10-81000

P NO. 4

R

3.1.7 WEIGHT (Continued)

- c. Full Pressure Suit - Body Restraint System 32.5 lbs
(including hose, electrical wiring and upper
part of pilot services disconnect and bail-
out oxygen)

Monthly weight and balance reports shall be submitted as specified in D2-80396, "General Requirements Document for Dyna-Soar Source Control Drawings and Design Procurement Specifications."

3.2 SYSTEM DESIGN. The ejection seat and survival system shall be designed to provide a maximum degree of reliability of operation and require a minimum amount of maintenance. In addition, the seat shall be designed to provide maximum comfort, ease of adjustment (ground maintenance only), simplicity, durability, and minimum weight. Specifications and standard parts shall be selected per D2-80396, except that D-590, Book 31, need not be complied with.

3.2.1 SEAT ADJUSTMENT. The seat shall be designed to provide vertical adjustment and seat back tilt adjustment. Vertical adjustment of the seat will not be required in flight, but will be a preflight operation on the ground.

3.2.1.1 VERTICAL ADJUSTMENT. Preflight vertical seat adjustment shall provide 2.9 inches up, and 1 inch down from the normal seat reference point (SRP) as shown in Figure 1.

3.2.1.1.1 DELETED

3.2.1.2 SEAT BACK TILT ADJUSTMENT. The seat back shall be designed to provide manual seat back tilt positioning. The seat positioning lever or control shall be located on the top of the left hand side panel in a convenient and readily accessible position to the pilot or ground crew. Seat back tilt shall provide two positions with stops, namely; "Boost" position 2° forward of normal vertical, and "Ejection" position 13° aft of normal vertical, as shown in Figure 1. The flight position may be selected anyplace between the two positions at the pilot's option.

For the ejection sequence, the seat back shall be automatically power actuated to the ejection position and locked in place by a ballistic powered actuator or similar device. Electric powered actuators or devices shall not be used. This function shall be included in the seat pre-ejection sequence. Automatic seat back positioning may be incorporated into inertia reel design (paragraph 3.2.6) eliminating the need for a separate seat back positioning actuator. Positioning of seat back to the ejection position under forward accelerations (eyeballs in) shall not result in pilot injury of any kind. Failure of automatic pre-ejection seat positioning shall not prevent seat ejection. (See Figure 2.)

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

THE BOEING COMPANY

10-81000

P NO. 11

3.2.10 ARM SUPPORTS.

3.2.10.1 UPPER ARM SUPPORT. Arm supports shall be provided on each side of the ejection seat back to provide maximum support to the upper arms of the pilot during boost. The arm supports must clear the 28 inch hatch envelope although they may exceed the nominal 25 inch ejection envelope. The arm supports shall be adjustable for 1.00 inch forward and one inch aft at the nominal position. The adjustment shall be designed such that the top and bottom ends may be moved throughout the adjustment either jointly or separately. See Figure 1, page 23.

3.2.10.2 FOREARM SUPPORT. Forearm supports shall not be provided.

3.2.10.3 ARM SUPPORT UPHOLSTERY. The contact surface of the arm supports shall be padded with a high energy absorbing material. The color of the padded surfaces shall be maroon, No. 21136, per Federal Standard No. 595.

3.2.11 DELETED (Included in paragraph 3.2.1.)

3.2.12 EMERGENCY EJECTION CONTROLS AND PROVISIONS

3.2.12.1 EJECTION CONTROL. The seat shall incorporate a two handed control, located on the forward edge of the seat bucket between the pilot's legs. The control shall be conveniently placed so that it may be easily reached for emergency ejection, when in the ejection or boost position and while the pilot is wearing an inflated full pressure - body restraint suit. The position of the control shall be such that it is not a safety hazard, either in flight or on the ground. The shape and location of the ejection control shall enable the pilot in a pressurized suit to positively grasp the control and initiate the ejection sequence. The handle shall be located approximately as shown in Figure 1. The actuation of this control shall provide an initiation signal for escape hatch ejection as well as the other ejection functions. See paragraph 3.2.13. The ejection control shall be painted alternate orange-yellow color No. 23538 and black No. 37038 stripes, per Federal Standard No. 595. The black stripe shall be 1/4" wide and the orange-yellow stripe 3/4" wide. The actuating force shall be 20 pounds minimum and 40 pounds maximum.

3.2.12.2 ACTUATING LINKAGES. All linkages used for firing initiators shall be irreversible; i.e., it shall be impossible to fire any initiator except by the intended sequence of motions. Where initiators employed in conjunction with the integrated full pressure - body restraint suit releases, shields or guards shall be employed to preclude the possibility of inadvertent firing. No unshielded cables or lanyards shall be used to actuate initiators. Push-pull type controls shall not be used unless they can meet the irreversibility requirement. All actuating mechanisms shall be so located or shielded that they will not tend to catch on clothing of pilot or servicing personnel, or to serve as hand holds. No linkage shall depend on locknuts to keep adjustment, but shall be non-adjustable or shall be pinned or otherwise permanently fastened after an initial adjustment for required travel.

3.2.12.3 DELETED.

DYNA-SOAR EJECTION SEAT AND SURVIVAL SYSTEM	BOEING AIRPLANE COMPANY	10-81000
		P NO. 13a

3.2.12.4 CHAFF. Provisions shall be made for installing two units of chaff per seat. The units of chaff (GFAE) are to be equivalent to type RR44 modified (i.e., individual cartons with tape broken away). The provisions for installing the chaff shall be on the ejectable structure and shall be such that there is a maximum tendency for the airstream to open the cartons and disperse the chaff as soon as possible after ejection. The chaff carton container shall be accessible so that the cartons may be easily inserted or removed. The container shall be clearly stenciled in letters approximately .50 inch high, "Container - Chaff Dispensing Unit."

3.2.12.5 PERSONAL LEADS, WIRING AND TUBING DISCONNECT - FIXED TO EJECTABLE STRUCTURE. A disconnect shall be installed on the right hand side of the seat to provide for disengagement of electrical communications, suit O₂N₂ requirements, physiological instrumentation, and defog electrical requirements as shown on Figure 8, Page 31a. Other disconnects are required per paragraphs 3.2.13.1 and 3.2.13.2 to functionally connect the seat to the glider. The disconnect for the various fittings shall positively lock the fittings on either side together and not allow separation until ejection, intentional pilot egress, or when servicing the seat. Devices such as shear pins or lockwire shall not be employed to hold the disconnect together. A lanyard shall be provided on the top (pilot pressure suit) portion. Pulling this lanyard shall disconnect this top portion only. A lanyard shall also be provided on the bottom (glider) portion suitable for attaching to glider structure. Pulling this lanyard shall disconnect both the top and bottom portions of the disconnect. Where more than one ejection system tube is routed through the disconnect, fittings and/or tubing shall be so designed that it is impossible to inadvertently cross tubing. The location of this disconnect shall be such that it is not subject to damage by flight or servicing personnel yet is visible for inspection and readily accessible for any required servicing operation. The underside of the disconnect brackets shall be of such distance above the surface of the floor (See Figure 8) as to assure access for servicing. The ejection seat Vendor shall furnish the pilot services disconnect. The seat Vendor shall transmit the pressure suit portion (top) to the pressure suit manufacturer for incorporation into the pressure suit. The seat Vendor shall transmit the glider portion (bottom) of the disconnect to The Boeing Company for incorporation into the glider. The Vendor shall make mounting provisions for these such that they are positively retained in the disconnect brackets and yet can be easily removed or replaced for servicing. The design of the disconnect brackets and all connectors and fittings used thereon will require close coordination between Boeing and the Vendor as the overall design of the seat progresses.

3.2.12.6 PROVISIONS FOR INSTALLING CARTRIDGE OPERATED UNITS. Installed provisions for all mechanically fired initiators shall be such that with initiators installed the initiator safety pins can be readily inserted and removed. All units shall be so located that safety pin installation and tubing connections can be easily inspected visually. Initiator mounts shall be such that it will be impossible to inadvertently interchange initiators. It shall also be impossible to interchange gas inlet and exit ends of initiators.

3.2.12.7 GROUND SAFETY PIN. Two ground safety pins shall be furnished with the seat. The linkage between the ejection control and initiator and between the harness release handle and mechanism, shall be designed so that when force is applied to the linkage when the control is safetied it will not operate. The safety pins shall be easily removed by the pilot when sitting in the seat. They shall be attached to a common warning streamer conforming to Air Force drawing 52C1543. The attachment pin to streamer shall be such as to preclude inadvertent separation. The streamer shall have a two inch diameter circle on each end with a 1 1/4" high numeral "1" inside at the ejection control end and "2" at the harness release handle end. The streamer shall have the following note in 1/2 inch high letters: "PILOT ESCAPE SYSTEM."

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

THE BOEING COMPANY

10-81000

P NO. 14

3.2.12.8 MAINTENANCE SAFETY PINS AND STREAMERS. It is a requirement that all mechanically fired initiators in the emergency escape system be provided with safety pins attached to standard warning streamers conforming to Air Force Drawing 55C598 except as noted in paragraph 3.2.12.7. These safety pins and streamers are installed during airplane maintenance. Although the maintenance pins and streamers are not to be furnished by the Vendor as part of this specification, their description is included in this document to clarify overall requirements.

3.2.12.9 PROVISIONS FOR INSPECTION AND TEST CAPABILITY. The seat design shall be such that any mechanisms which must necessarily assume locked position during the course of functional test and inspection shall be easily unlocked and restored to normal position without tools or else by the use of simple tools. Consideration shall be given to the fact that although the ejection mechanisms function only once to attain emergency escape they actually may be operated during periodic inspection checks.

3.2.13 EJECTION SEQUENCE. The sequence of operation of the entire emergency escape system is included in this specification to clarify the function of the seat as a component of the entire system. (See Figure 2).

3.2.13.1 ESCAPE HATCH INTERFACE. The ejection seat system shall supply an escape hatch initiation signal upon actuation of the ejection handle. This signal shall consist of a gas charge to a pressure switch supplied and installed on glider structure by The Boeing Company. A pneumatic disconnect fitting between the ejection seat and glider structure shall be selected for the hatch jettison initiator by the Vendor. It shall be located in a position to allow disengagement when the seat starts up the rails and as close to the upper part of the cockpit aft bulkhead as practical. The disconnect shall be installed such that the hose on the glider side will not be subjected to the separation forces. The Boeing Company will furnish the bottom half (glider side) of the disconnect and the hose from there to the pressure switch, and the Vendor shall supply and mount the fixed half of the disconnect as well as the seat tubing.

3.2.13.2 SEAT CATAPULT DEACTIVATION INTERFACE. The external hatch release system on the Dyna-Soar glider is required to deactivate the ejection seat catapult prior to pilot removal from the glider.

The Vendor shall install (1) an electrically initiated, ballistic actuated tube-cutter on the gas line to the rocket catapult, (2) one-half of an electrical disconnect plug, and (3) interconnect wiring between the tube-cutter and disconnect. The Vendor shall select the tube-cutter and disconnect hardware and shall advise The Boeing Company of the electrical requirements. The electrical characteristics of the system must be such as to not interfere with reliable firing of the hatch jettison system (using the same battery supply). Boeing will furnish the lower half (glider side) of the disconnect and the Vendor shall supply and mount the top (fixed) half.

The disconnect should be mounted in conjunction with the pneumatic disconnect for ejection seat controlled escape hatch jettison outlined in paragraph 3.2.13.1.

All lead length in excess of six inches total will be shielded twisted pair, or a single coaxial cable.

The initiator only shall meet the following requirements without the use of external shunts:

3.2.13.2.1 NO FIRE. It shall not fire as a result of the application of a direct

DYNA-SOAR EJECTION SEAT AND SURVIVAL SYSTEM	BOEING AIRPLANE COMPANY	10-81000
		P NO. 15

4.4.19. SLED TESTS. The seat supplier shall perform these tests as test contractor or test conductor (in conjunction with AFFTC Sled Track Branch) under Boeing surveillance. As such, the Supplier will manage the test program at the test site and will be the direct agent dealing with the Air Force Sled Track Branch. Boeing coordination with the AFFTC Test Branch will be through the test contractor.

For the seat ejection system, the seat supplier will be responsible for the design, test and qualification of the complete system, sub-assemblies and parts. For the hatch and hatch jettison system, the seat supplier is not responsible for the design, fabrication or performance of the system or components. He will be responsible for preparing and conducting the tests, including designated instrumentation, and supplying test data.

For the heat shield, the test contractor, as in the case of the hatch system, is not responsible for the design, fabrication or performance of the system or components. He will be responsible for preparing and conducting the tests, including designated portions of the instrumentation, and supplying test data in accordance with Appendix "B" of this drawing.

A Government-furnished full pressure suit will be used (on a 75th percentile dummy) on all ejection system tests. These tests will be considered final Air Force qualification of the suit and attached connections. The test contractor will not be responsible for any qualification on this article. No suit instrumentation will be required. Maintenance of the suits or any particular requirements for the suits during the test program will be furnished by the Air Force or the suit contractor.

The test contractor will provide Boeing (and AFFTC as required) installation drawings prepared by him, of test items, lists of equipment furnished by him, and supporting data prepared by him, associated with the program. He will be responsible for full engineering and liaison support at the test site for all hardware and test equipment for which he is responsible. He will provide technicians or specialists needed to maintain test and associated equipment as required by the AFFTC. He will provide routine maintenance on Boeing furnished items, but he will not be responsible for major maintenance, rework or refurbishment of Boeing articles unless by special arrangement with Boeing.

The test contractor will provide interim reports after each sled run, with a copy to AFFTC. These will include test conditions and results, data reduced from the run, detail failure analysis of the ejection system and recommended action preparatory to the next test run. Detail failure analysis of the hatch and its jettison system or the heat shield and its jettison system, will be the responsibility of Boeing, and not the test contractor.

The Air Force has agreed to furnish all test data reduction from the Edwards facility. However, the test contractor is not relieved of the responsibility of insuring timely reduction of the ejection system test data. He will not be required to assume responsibility for the hatch and heat shield data reduction, that is distinct from the ejection initiation system, although this too will be performed by the Air Force Edwards facility and, as such, is to be packaged into the interim reports.

The test contractor will be responsible for prompt acquisition and transmittal to

9
DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

THE BOEING COMPANY

10-81000

P NO. 21

4.4.19 CONTINUED.

Boeing of all test data as soon as available from Edwards.

A final and detailed test report will be required, suitable for demonstration of the performance qualification of the complete ejection system. Boeing will perform any added final reporting required for the hatch and heat shield systems.

The test contractor will be responsible for test area cleanup, disposition, and any required shipment of test equipment.

4.4.19.1 The sled test program will consist of the following minimum requirements. Four ejection seat runs will be planned. Three runs will be accomplished (one each) at velocities of 70 K, 400 K and 510 knots. They do not necessarily have to proceed in this order. The fourth run will be reserved for accumulated pick-up items, or possible ejection under acceleration, simulating direct ejection during boost. One sled drag calibration run will be planned prior to any test runs.

4.4.19.2 The seat shall withstand the ejection loads and demonstrate satisfactory performance as specified in sections 3.3 and 3.4.

4.4.19.3 Boeing will furnish the test sled vehicle. Boeing will also supply all instrumentation sensors or components that must be integral with Boeing furnished components or sled structure. In addition, all provisions for instrumentation, power supply, camera mounts and access will be supplied with Boeing items in so far as is feasible.

The AFFTC Track Branch will supply the sled vehicle slippers, and the rocket pusher/water brake sled.

The test contractor will supply all other test items and equipment, including instrumentation, not available from AFFTC. The instrumentation requirements will be worked out between the test contractor and AFFTC, incorporating Boeing furnished requirements for the hatch and heat shield systems.

4.4.19.4 The escape hatch will be tested on all ejection seat sled runs and will be initiated by the normal ejection seat system. Test hardware, special tools and installation instructions will be provided by The Boeing Company.

Test data will consist of time referenced data on hatch motion and trajectory for at least 30 feet of separation, and functioning sequence of initiator ignition and thruster stroke.

Proposed Instrumentation:

- (1) Metric range camera coverage (1000 frames/sec).
- (2) Camera mounted in glider nose or on outrigger, looking aft (1000frames/sec).
- (3) Cockpit mounted camera looking up (1000 frames/sec).
- (4) Initiation current for each of two parallel ignition circuits. Measure voltage across a current limiting resistor which will be an integral part of the hatch circuit, 0-28 volts, 3 millisecond response.

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 21a

- (5) Thruster stroke (2), ± 2 millisecond time reference, 4 inch thrust.
- (6) Thruster internal pressure (2), 0-5000 psi, ± 2 millisecond time reference, from a pressure tap that will be provided on thruster.

4.4.19.5 The Vendor shall supply the necessary quantities of ejection seat and survival systems described in this document, and anthropomorphic dummy to support these tests. The anthropomorphic dummy shall be of a 75th percentile in accordance with WADC Technical Report No. 52-321, dated September 1954.

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 21b

4.4.19.6 The anthropomorphic dummy shall be instrumented to measure acceleration forces throughout the ejection, seat separation, and descent sequences.

4.4.19.7 The entire test program will be conducted in accordance with a test plan and detail test procedure to be submitted for Boeing approval in accordance with D2-80396, General Requirements Document for Dyna-Soar Source Control Drawings and Design Procurement Specifications. Boeing test requirements and procedures necessary for the hatch and heat shield are to be furnished by Boeing for inclusion in the subcontractor test plan and procedure.

4.4.20 SURVIVAL KIT TEST. Demonstrate the ability of the survival kit to meet the requirements of paragraph 3.2.18 except that the raft shall not be inflated.

4.4.21 TUBE CUTTER TESTS. Demonstrate the ability of the tube cutter to meet the requirements of paragraph 3.2.13.2.

5.0 PREPARATION FOR DELIVERY

5.1 PREPARATION FOR DELIVERY. Packaging and marking of the article procured by this drawing shall be in accordance with the provisions of D2-80396, General Requirements Document for Dyna-Soar Source Control Drawings and Design Procurement Specifications.

6.0 NOTES.

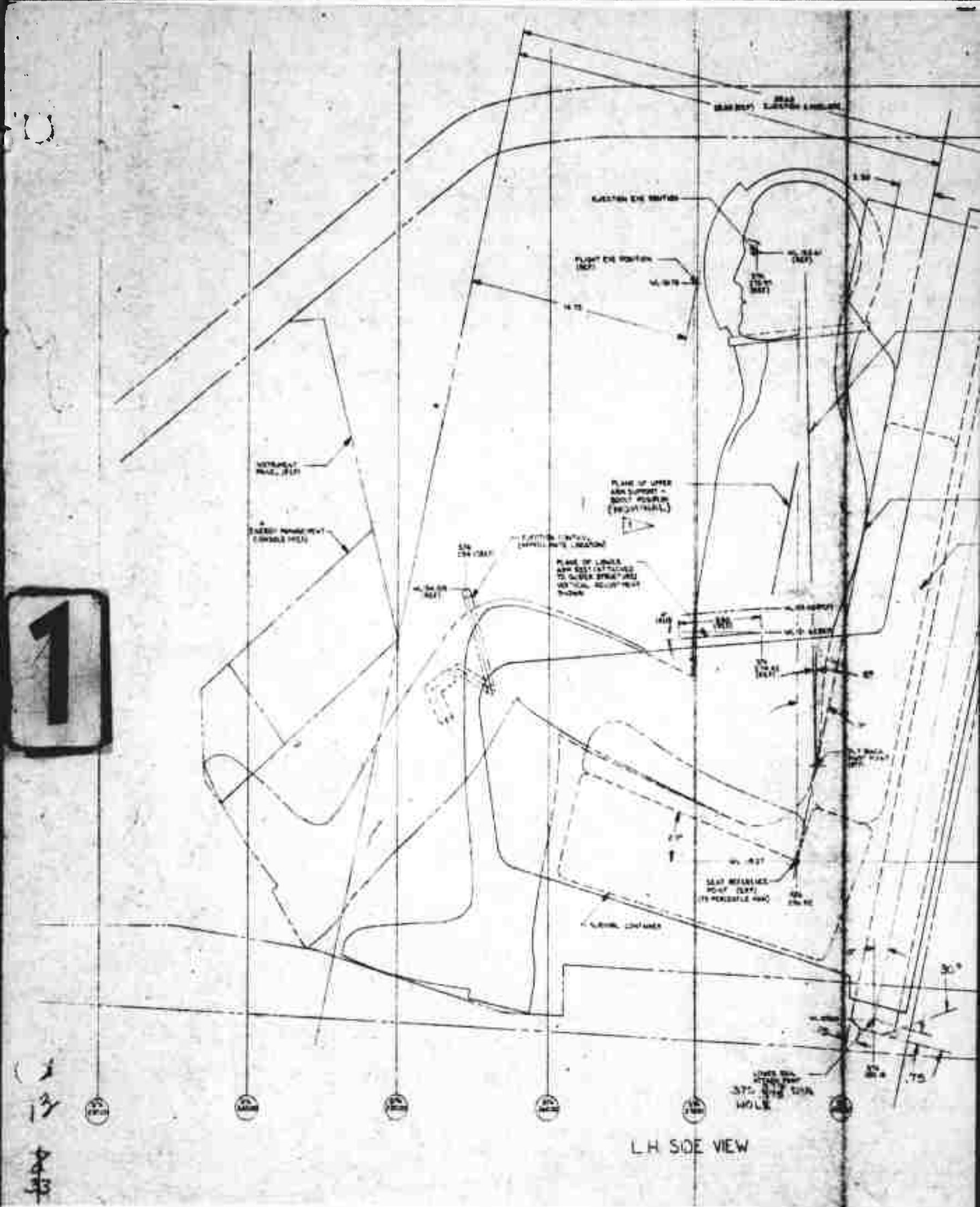
6.1 EJECTION SEAT INTERFACE. Boeing shall provide ejection seat interface design information and conduct all necessary liaison with the Vendor to accomplish service connections from the glider, escape hatch actuation, seat deactivation, and glider structural attachment. The Boeing Company shall provide the seat Vendor master gage tooling for location of rail attach points.

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

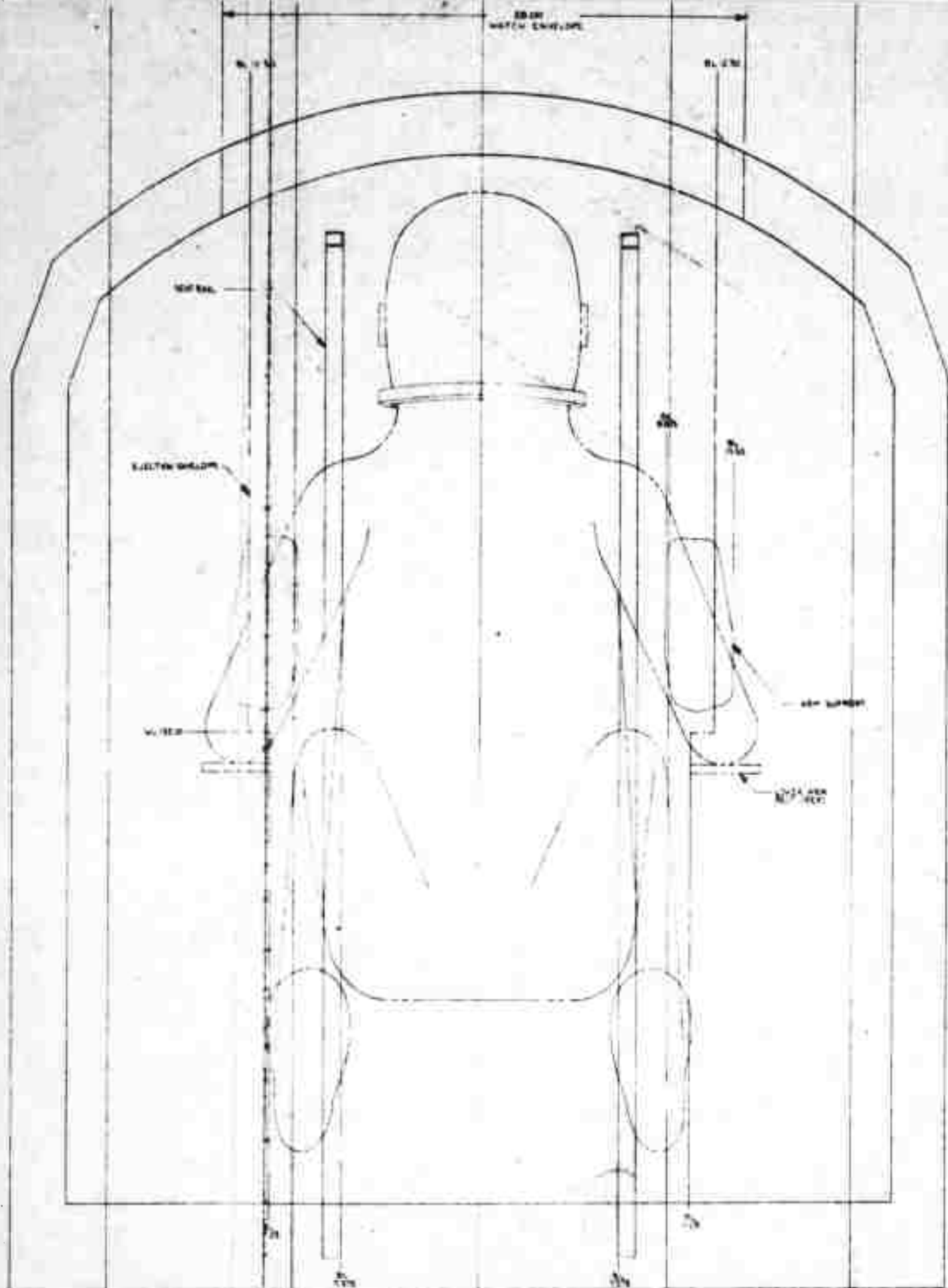
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10-81000

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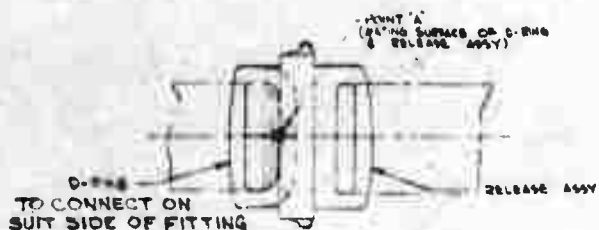
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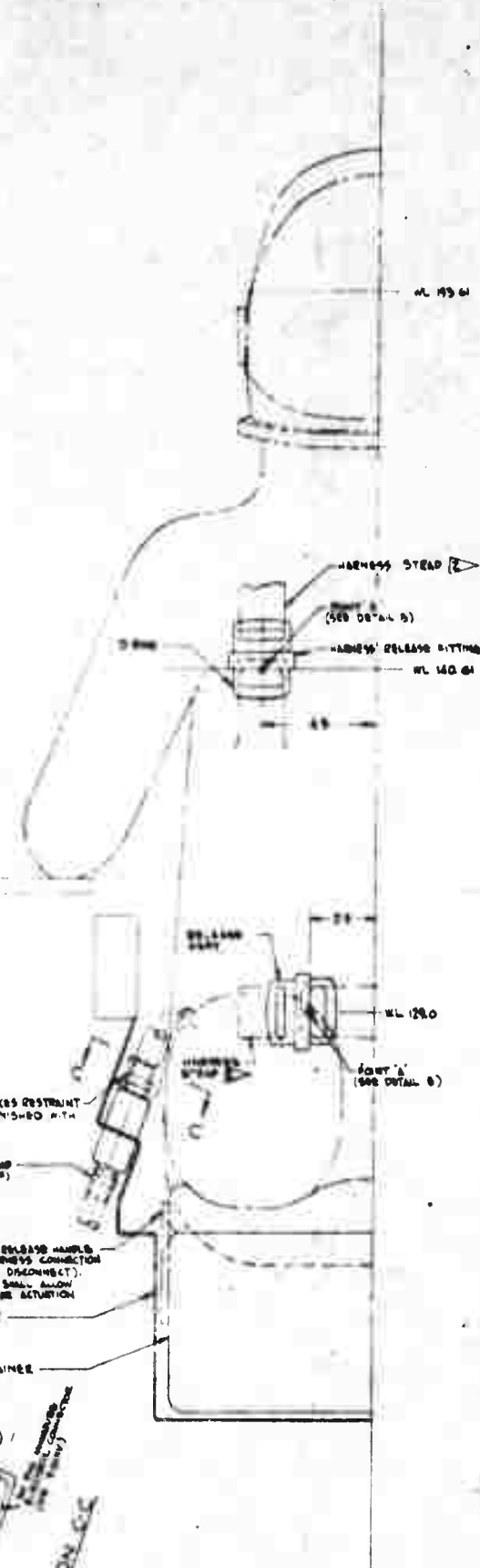
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LOCATION TO BE DETERMINED

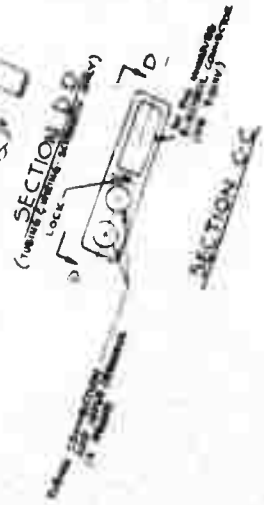
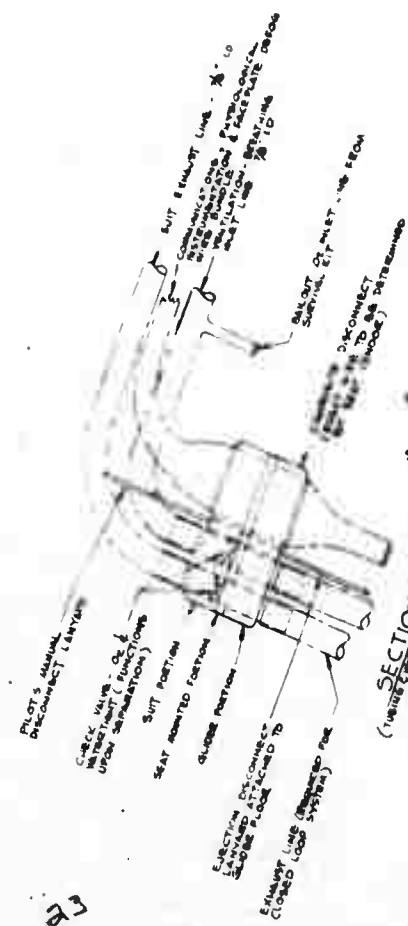
FIGURE 1



DETAIL B
HARNESS RELEASE FITTING
 SCALE - FULL SIZE



SECTION A-A



1

APPENDIX "B"HEAT SHIELD SLED TEST REQUIREMENTS

While in no way part of the escape system, the windshield heat shield will be qualification tested in this sled program, due to the similarity of test procedures and to take advantage of the available test vehicle, facilities, instrumentation, test personnel and compatible time scale.

The window heat shield jettisoning will be tested on three sled runs at velocities and glider angle of attack to be determined at a later date. Initiation will be accomplished by an electrical signal from the track screen-box cutter system.

Test data will consist of time referenced data on shield motion and trajectory from first motion of the shield to at least 40 feet of separation, actuator stroke, actuator load, and actuator pressure.

Proposed Instrumentation:

- (1) Metric range camera coverage (1000 frames/sec).
- (2) Camera mounted in glider nose or on outrigger looking aft (1000 frames/sec).
- (3) Actuator stroke transducer (to be determined).
- (4) Actuator load transducer (to be determined).
- (5) Actuator pressure transducer, "T" off of input fitting (0-3000 psi).

Three heat shield runs will be required at velocities to be determined. It is the intent to combine as many of these tests as possible with seat ejection runs, if compatible test parameters can be established. If not, separate heat shield runs will be required. At this time, it is necessary to assume that separate heat shield runs are required. Additional tests beyond the above will be accomplished only if the required qualification results are not obtained in the minimum schedule.

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SEATTLE, WASHINGTON

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SOURCE CONTROL DRAWING

DRAWN	Joseph M. Dottem Bill S. Mill	DATE	6-1-61	DYNA-SOAR EJECTION SEAT AND SURVIVAL SYSTEM	BOEING AIRPLANE COMPANY AERO-SPACE DIVISION SEATTLE 24, WASHINGTON
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USED ON	Dyna-Soar 1		10-81000		
CODE				PAGE 1	OF 34

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
DYNA-SOAR EJECTION SEAT AND SURVIVAL SYSTEM		BOEING AIRPLANE COMPANY SEATTLE 24, WASHINGTON	

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10-81000
P NO. 2

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TABLE OF CONTENTS

	<u>PAGE</u>
1.0 SCOPE	8
1.1 SCOPE	8
1.2 INTENDED USE AND ASSEMBLY BREAKDOWN	8
2.0 APPLICABLE DOCUMENTS	9
2.1 GOVERNMENT	9
2.2 NON-GOVERNMENT	9
3.0 REQUIREMENTS	10
3.1 GENERAL REQUIREMENTS	10
3.2 SYSTEM DESIGN	11
3.3 EJECTION SEAT AND SURVIVAL SYSTEM CONSTRUCTION	17
3.4 SYSTEM PERFORMANCE	18
4.0 QUALITY ASSURANCE PROVISIONS	20
4.1 GENERAL	20
4.2 PRE-PRODUCTION TESTS	20
4.3 ACCEPTANCE TESTS	20
4.4 BOEING RECEIVING-INSPECTION AND FUNCTIONAL TESTS	20
4.5 SLED TESTS	21
5.0 PREPARATION FOR DELIVERY	22
6.0 NOTES	22
6.1 EJECTION SEAT INTERFACE	22
APPENDIX A DEVIATIONS TO MIL-S-9479, SEAT, UPWARD EJECTION, AIRCRAFT	32

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 4

1	-4	PARACHUTE ASSEMBLY			
1	-3	ROCKET CATAPULT ASSEMBLY			
1	-2	RESCUE & SURVIVAL KIT CONTAINER ASSEMBLY			
1	-1	EJECTION SEAT AND RAIL ASSEMBLY			
REQD	PART NO.	DESCRIPTION	MATL	MATL SPEC	WT
LIST OF MATERIAL					
DYNA-SOAR EJECTION SEAT AND SURVIVAL SYSTEM			BOEING AIRPLANE COMPANY		10-81000
				P NO.	5

LIST OF FIGURES

	<u>PAGE</u>
FIGURE 1 EJECTION SEAT AND SURVIVAL SYSTEM ENVELOPE	23
FIGURE 2 EJECTION SEQUENCE	24
FIGURE 3 DYNA-SOAR ESCAPE ENVELOPE	25
FIGURE 4 CLEARANCE ENVELOPE REQUIREMENTS - MINIMUM EJECTION TRAJECTORY	26
FIGURE 5 GLIDER TO B-52 WING INSTALLATION	27
FIGURE 6 SEAT/MAN EJECTION TRAJECTORIES (6a, 6b)	28, 29, 30
FIGURE 7 VIBRATION ENVIRONMENTAL REQUIREMENTS	31

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 7

1.0 SCOPE

1.1 SCOPE.

This drawing covers the design, fabrication, performance and testing requirements for a type of equipment designated Ejection Seat and Survival System.

1.2 INTENDED USE AND ASSEMBLY BREAKDOWN

1.2.1 EJECTION SEAT AND SURVIVAL SYSTEM. 10-81000

The specified ejection seat and survival system shall provide for pilot escape and survival from the Dyna-Soar glider in instances when a satisfactory landing site cannot be reached or when other conditions make an attempted glider landing impractical.

1.2.1.1 EJECTION SEAT AND RAIL ASSEMBLY. 10-81000-1

The upward ejection seat and rail assembly for the Dyna-Soar vehicle shall be patterned after existing state-of-the-art ejection seats. Size requirements for the pilot are based on a 5th to 75th percentile man, (maximum) fully dressed in a full pressure - body restraint suit system. The pilot's anthropometry shall comply with WADC Technical Report 52-321, "Anthropometry of Flying Personnel", dated September, 1954. A hinged seat back shall provide for two positions of flight; Boost, and Normal Flight/Ejection. A qualified Air Force back type parachute and a seat type rescue and survival kit, shall be provided. Ejection sequencing shall be accomplished by actuating a two handed ejection control located on the front edge of the seat bucket between the pilot's legs. This action shall automatically pre-position and restrain the pilot for ejection, deploy elbow restraints, eject the hatch, provide system disconnect, supply the pilot suit with bail-out oxygen, and fire a rocket catapult. After ejection, automatic seat/man separation shall be provided, with automatic parachute deployment at 14,000 feet or less.

1.2.1.2 RESCUE AND SURVIVAL KIT CONTAINER ASSEMBLY. 10-81000-2

The rescue and survival kit container assembly will include a bail-out oxygen bottle and regulator system, and will provide storage space for the life raft, rescue aids, and emergency survival equipment. The assembly shall be used as a seat cushion and parachute support during flight.

1.2.1.3 ROCKET CATAPULT ASSEMBLY. 10-81000-3

A qualified rocket catapult assembly shall provide the necessary energy for propelling the seat/man/survival equipment from the glider on a safe trajectory before parachute deployment.

1.2.1.4 PARACHUTE ASSEMBLY. 10-81000-4

A qualified type B-5, or equivalent, back type parachute with modified attachments, and re-packaged as necessary to provide proper back contours for body support during boost, shall be provided with the ejection seat and survival system.

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 8

2.0 APPLICABLE DOCUMENTS

2.1 GOVERNMENT. The following Government documents of the exact issue noted, together with the noted revisions thereto constitute a part of this Source Control Drawing, but only to the extent defined herein. In those cases where the document listed is not dated, the issue in effect on the date of invitation for bids, shall form a part of this Source Control Drawing. When conflicting requirements exist, the requirements of this Source Control Drawing shall govern.

MIL-S-9479

Seat: Upward Ejection, Aircraft,
dated 19 March 1954

MIL-E-5272C

Environmental Testing, Aeronautical
and Associated Equipment, General
Spec. For, dated 13 April 1959Federal STD
No. 595

Colors

WADC Technical
Report 52-321Anthropometry of Flying Personnel -
1950 dated September 1954

2.2 NON-GOVERNMENT. The following non-government documents and drawings of exact issues shown, form a part of this Source Control Drawing to the extent specified herein. In those cases where the document is not dated, the latest issue in effect on the date of invitation for bids shall form a part of this Source Control Drawing. One copy each of the documents listed below and marked with an asterisk is to be furnished with each copy of this Source Control Drawing being sent to a Vendor.

*D2-6558

General Requirements Supplement to the
Source Control Drawing for Dyna-SoarDYNA-SOAR EJECTION SEAT AND SURVIVAL
SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 9

3.0 REQUIREMENTS

3.1 GENERAL REQUIREMENTS

3.1.1 SUPPLEMENTAL DOCUMENT. Requirements, procedures, references, and definitions specified in Document D2-6558 form a part of this Source Control Drawing. Where conflicting requirements exist, the requirement of this Source Control Drawing shall govern.

3.1.2 MIL SPECIFICATION COMPLIANCE. The general design and development requirements of MIL-S-9479 dated 19 March 1954 shall apply with the exception of deviations as written in this drawing.* In the event of conflict between this drawing and MIL-S-9479, the requirements of this drawing shall govern.

3.1.3 SYSTEM COMPATIBILITY. The ejection seat and survival system listed below shall be compatible and shall operate as an integrated system to perform the interrelated functions herein defined:

- a. 10-81000-1 Ejection Seat and Rail Assembly
- b. 10-81000-2 Rescue and Survival Kit Container Assembly
- c. 10-81000-3 Rocket Catapult Assembly
- d. 10-81000-4 Parachute Assembly

The requirements of this drawing shall be considered as applicable in the design of each of the assemblies listed above.

3.1.4 SYSTEMS INTEGRATION. The ejection and survival system shall be so designed that it will meet the performance requirements specified herein when integrated with the full pressure suit - body restraint system, escape hatch ejection system, and glider - pilot service connections. The ejection sequence shall conform to the sequence and integration shown in Figure 2.

3.1.5 PREPRODUCTION. This specification makes provisions for preproduction testing.

3.1.6 FINISH. All external non-operating surfaces shall be given two coats of Medium Gray lacquer, conforming to color number 36231 of Federal Standard No. 595, except as herein noted.

* See Appendix A

DYNA-SOAR EJECTION SEAT AND SURVIVAL
SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 10

3.2 SYSTEM DESIGN. The ejection seat and survival system shall be designed to provide a maximum degree of reliability of operation and require a minimum amount of maintenance. In addition, the seat shall be designed to provide maximum comfort, ease of adjustment (ground maintenance only), simplicity, durability, and minimum weight.

3.2.1 SEAT ADJUSTMENT. The seat shall be designed to provide vertical adjustment and two seat back positions. Vertical adjustment of the seat will not be required in flight, but will be a preflight operation on the ground.

The seat back shall be capable of being manually positioned to the boost position (8° forward of vertical) prior to boost and shall be capable of being manually returned to the normal flight position (13° aft of vertical) after termination of boost. These positions are shown in Figure 1.

For the ejection sequence, the seat back shall be power actuated to the normal flight/ejection position and locked in place by a ballistic powered actuator or similar device. Electric powered actuators or devices shall not be used. This function shall be included in the seat pre-ejection sequence. Seat back positioning may be incorporated into inertia reel design (paragraph 3.2.6) eliminating the need for a separate seat back positioning actuator. Positioning of seat back to the ejection position under forward accelerations (eyeballs in) shall not result in pilot injury of any kind.

Special consideration shall be given to the requirements for pilot entry into the seat while the vehicle is in a vertical position on the launch pad. The seat back shall be in the "normal flight/ejection" (aft) position. The head rest shall be readily removable to reduce interference problems during pilot entry into the cockpit. Under this condition the pilot shall be able to enter the seat fully dressed in a full pressure - body restraint suit. After entry is accomplished the pilot or assisting crew shall be able to tilt the seat forward to the "boost" position. The seat positioning lever or control shall be located on the seat in a convenient and readily accessible position to the pilot or ground crew.

3.2.1.1 VERTICAL ADJUSTMENT. Preflight vertical seat adjustment shall provide 2.9 inches up, and 1 inch down from the normal seat reference point (SRP) as shown in Figure 1.

3.2.1.1.1 Thrust vector should be adjusted to pass through the center of gravity of man/seat as a preflight operation.

3.2.1.2 SEAT BACK POSITIONS. Seat back tilt shall provide two positions, namely; "Boost" position 8° forward of vertical, and "Normal Flight/Ejection" position 13° aft of vertical, as shown in Figure 1.

3.2.2 EQUIPMENT INSTALLATION PROVISIONS. Installation provisions for a qualified B-5 back type personnel parachute assembly with modified attachments as outlined in paragraph 3.2.20, and a rescue and survival kit container assembly as outlined in paragraph 3.2.18, shall be provided in the ejection seat.

3.2.3. SEAT CUSHION. The seat cushion shall be included as part of the rescue and survival kit container assembly. The seat cushion shall be of a maroon color conforming with Federal Standard No. 595, Color 21136.

DYNA-SOAR EJECTION SEAT AND SURVIVAL SYSTEM	BOEING AIRPLANE COMPANY	10-81000 P NO.11
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3.2.4 PARACHUTE SUPPORT BULKHEAD. The aft end of the rescue and survival kit container assembly shall provide vertical support for the parachute.

3.2.5 FULL PRESSURE SUIT - BODY RESTRAINT SYSTEM, PARACHUTE AND SURVIVAL GEAR ATTACHMENT. Provisions shall be made for connection of the Full Pressure Suit - Body Restraint System (Government procured - bailment item) to the Ejection Seat and Survival System. Two separate types of fittings are required and are as follows:

(1) Suit to Seat-Parachute-Survival Kit Attach Fittings

Two shoulder and two hip attach fittings are required for attaching the pressure suit to the ejection seat, parachute, and survival gear. These fittings shall be a manual disconnect type which are easily manipulated by the pilot for both ingress and egress from the glider without the parachute or survival kit attached to the suit. The harness assembly from suit to seat shall provide sufficient adjustment to enable the pilot to engage his four attach fittings and tighten the harness for restraint.

The ejection seat Vendor shall design or determine the suit to seat-parachute-survival kit attach fittings and shall transmit to Boeing the mating pressure suit fitting for incorporation into the pressure suit.

(2) Seat to Suit-Parachute-Survival Kit Attach Fitting

Seat to suit-parachute-survival kit attach fittings shall be automatically disconnected after catapult rocket burnout but prior to man/seat separation. Automatic actuation of these fittings shall be accomplished by some type of gas cylinder energized by a delay initiator. The automatic release system shall be one direction, i.e., when fittings have opened for man/seat separation they cannot return to the closed position. The delay initiator shall be actuated as the seat travels up the ejection rails.

The initiator actuation mechanism shall be designed so that when the ejectable portion of the seat is installed on the fixed rails, the mechanism is automatically engaged. A device shall be provided which will allow manual removal of the ejection seat without firing the delay initiator.

A single manual release handle, easily accessible to either the pilot or the ground crew, shall release the seat from the suit, parachute and survival kit and shall release the pilot services disconnects (oxygen, communications and physiological instrumentation) and parachute lanyard for emergency pilot egress. The pull force on this control shall release the seat to suit-parachute-survival kit attach fittings.

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 12

3.2.6 INERTIA REEL. An inertia reel shall be mounted on the seat back for shoulder restraint. The inertia reel shall restrain the pilot in the seat under high aft (eyeballs out) accelerations. Under normal conditions the inertia reel shall allow the pilot to assume the flight position. At initiation of the escape system, the inertia reel strap shall be automatically retracted, locking the pilot in the ejection position.

The inertia reel shall be easily accessible for servicing or replacement. The manual inertia reel lock control shall be located on the left hand side of the seat and shall be readily accessible to the pilot.

The inertia reel design may be such that it will also perform the function of seat back positioning outlined in paragraph 3.2.1, thus eliminating the need for a separate seat back positioning actuator.

3.2.7 MAN-SEAT SEPARATOR. After seat to suit-parachute-survival kit release, a positive means of separation of the pilot (with parachute and survival gear) from the ejection seat shall be provided. Man-seat separator shall not be activated until seat release, either automatic or manual, has been accomplished.

3.2.8 HEAD REST. The head rest shall be attached to the tilting back structure and shall remain stationary with respect to it when the seat back is tilted. The head rest shall be readily removable to reduce interference problems during pilot entry into the pilot compartment. Up and down head rest adjustment, and variable inserts, shall be provided to accommodate different size and shape pressure suit helmets.

The contact surfaces of the head rest shall be padded with a high energy absorbing material. The color of the padded surfaces shall be maroon, No. 21136, per Federal Standard No. 595. Special attention shall be given to insure that the upholstery will withstand the wear and handling of normal service usage.

3.2.9 LEG SUPPORTS. Contoured leg supports shall be provided on the front of the ejection seat to support the calf of the pilot's leg during boost and ejection. These supports in conjunction with the rest of the seat configuration shall prevent the legs from spreading beyond the ejection envelope.

3.2.10 ARM SUPPORTS.

3.2.10.1 UPPER ARM SUPPORT. Contoured arm supports shall be provided on each side of the ejection seat back to provide maximum support to the upper arms of the pilot during boost. The arm supports must clear the hatch envelope; although they may exceed the nominal 25 inch ejection envelope, since the pilot's arms will not be in this position during ejection. See Figure 1, Page 22.

3.2.10.2 FOREARM SUPPORT. Forearm supports shall be provided on each side of the ejection seat. These supports shall support the pilot's forearms during boost and normal flight and shall fold up and act as arm restraints during ejection. This system shall insure that the pilot's elbows will not exceed the 25 inch allowable width escape envelope.

3.2.10.3 ARM SUPPORT UPHOLSTERY. The contact surface of the arm supports shall be padded with a high energy absorbing material. The color of the padded surfaces shall be maroon, No. 21136, per Federal Standard No. 595.

3.2.11 EJECTION POSITION. The seat shall be designed to permit ejection only in the ejection position (13° aft of vertical). Automatic pre-ejection seat positioning shall be required. After boost, the pilot will manually position the seat to the ejection position.

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 13

3.2.12 EMERGENCY EJECTION CONTROLS AND PROVISIONS

3.2.12.1 EJECTION CONTROL. The seat shall incorporate a two handed control, located on the forward edge of the seat bucket between the pilot's legs. The control shall be conveniently placed so that it may be easily reached for emergency ejection, when in the ejection or boost position and while the pilot is wearing an inflated full pressure - body restraint suit. The stowed position of the control shall be such that it is not a safety hazard, either in flight or on the ground. The shape and location of the ejection control shall enable the pilot in a pressurized suit to positively grasp the control and initiate the ejection sequence. The actuation of this control shall provide an initiation signal for escape hatch ejection as well as the other ejection functions. See paragraph 3.2.13. The ejection control shall be painted orange yellow color No. 23538, per Federal Standard No. 595.

3.2.12.2 ACTUATING LINKAGES. All linkages used for firing initiators shall be irreversible; i.e., it shall be impossible to fire any initiator except by the intended sequence of motions. Where initiators are fired by unconnected mechanisms, as may be the case of the initiator employed in conjunction with the integrated full body restraint suit releases, shields or guards shall be employed to preclude the possibility of inadvertent firing. No unshielded cables or lanyards shall be used to actuate initiators. Push - pull type controls shall not be used unless they can meet the irreversibility requirement. All actuating mechanisms shall be so located or shielded that they will not tend to catch on clothing of pilot, or servicing personnel, or to serve as hand holds. No linkage shall depend on locknuts to keep adjustment, but shall be non-adjustable or shall be pinned or otherwise permanently fastened after an initial adjustment for required travel.

3.2.12.3 ELBOW RESTRAINT. An elbow restraint system shall be incorporated into the design of the seat arm rests outlined in paragraph 3.2.10.2. Elbow restraint shall be automatically deployed by the ejection control prior to ejection. This system shall insure that the pilot's elbows will not exceed the 25 inch allowable width escape envelope, as indicated in Figure 1.

3.2.12.4 CHAFF. Provisions shall be made for installing two units of chaff per seat. The units of chaff (GFAC) are to be equivalent to type RR44 modified (i.e., individual cartons with tape broken away). The provisions for installing the chaff shall be on the ejectable structure and shall be such that there is a maximum tendency for the airstream to open the cartons and disperse the chaff as soon as possible after ejection. The chaff carton container shall be accessible so that the cartons may be easily inserted or removed. The container shall be clearly stenciled in letters approximately .50 inch high, "Container - Chaff Dispensing Unit."

3.2.12.5 PERSONAL LEADS, WIRING AND TUBING DISCONNECT - FIXED TO EJECTABLE STRUCTURE. A disconnect shall be installed on the left hand side of the seat to provide for disengagement of electrical communications, suit O₂N₂ requirements and physiological instrumentation, and to provide the necessary receptacles and fittings required to functionally connect seat to glider. The disconnect for the various fittings shall positively lock the fittings on either side together and not allow separation until ejection, intentional pilot egress, or when servicing the seat. Devices such as shear pins or lockwire shall not be employed to hold the disconnect together. Where more than one ejection system tube is routed through the disconnect, fittings and/or tubing shall be so designed that it is impossible to inadvertently cross tubing. The location of this disconnect shall be such

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 14

3.2.12.5 CONTINUED. that it is not subject to damage by flight or servicing personnel yet is visible for inspection and readily accessible for any required servicing operation. The underside of the disconnect brackets shall be of such distance above the surface of the floor (See Figure 1) as to assure access for servicing. Boeing shall furnish the non-ejectable (power side) of the connectors. The Vendor shall make mounting provisions for these such that they are positively retained in the disconnect brackets and yet can be easily removed or replaced for servicing. The Vendor shall furnish Boeing as soon as possible with all information required for procurement of the power side of the connectors. The design of the disconnect brackets and all connectors and fittings used thereon will require close coordination between Boeing and the Vendor as the overall design of the seat progresses.

3.2.12.6 PROVISIONS FOR INSTALLING CARTRIDGE OPERATED UNITS. Installed provisions for all mechanically fired initiators shall be such that with initiators installed the initiator safety pins can be readily inserted and removed. All units shall be so located that safety pin installation and tubing connections can be easily inspected visually. Initiator mounts shall be such that it will be impossible to inadvertently interchange initiators. It shall also be impossible to interchange gas inlet and exit ends of initiators.

3.2.12.7 GROUND SAFETY PIN. Ground safety pin shall be furnished with the seat. The linkage between the ejection control and initiator shall be designed so that applying force to the linkage when the control is safetied will not operate the initiator. The safety pin shall be easily removed by the pilot when sitting in the seat. It shall be attached to a standard warning streamer conforming to Air Force drawing 52C1543. The attachment pin to streamer shall be such as to preclude inadvertent separation. The streamer shall have a two inch diameter circle on each end with a 1 1/4 inch high numeral "1" inside. The streamer shall have the following note in 1/2 inch high letters: "PILOT ESCAPE SYSTEM."

3.2.12.8 MAINTENANCE SAFETY PINS AND STREAMERS. It is a requirement that all mechanically fired initiators in the emergency escape system be provided with safety pins attached to standard warning streamers conforming to Air Force drawing 55C598 except as noted in paragraph 3.2.12.7. These safety pins and streamers are installed during airplane maintenance. Although the maintenance pins and streamers are not to be furnished by the Vendor as part of this specification, their description is included in this document to clarify overall requirements.

3.2.12.9 PROVISIONS FOR INSPECTION AND TEST CAPABILITY. The seat design shall be such that any mechanisms which must necessarily assume locked position during the course of functional test and inspection shall be easily unlocked and restored to normal position without tools or else by the use of simple tools. Consideration shall be given to the fact that although the ejection mechanisms function only once to attain emergency escape they actually may be operated during periodic inspection checks.

3.2.13 EJECTION SEQUENCE. The sequence of operation of the entire emergency escape system is included in this specification to clarify the function of the seat as a component of the entire system. (See Figure 2).

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 15

3.2.14 ROCKET CATAPULT ATTACHMENT. Provisions shall be made to install a qualified rocket catapult, by providing fittings to receive the rocket attaching block, on the seat structure. Provisions shall be made on the seat so that the rocket cannot strike the pilot during ejection. The Vendor shall provide the catapult to glider attach fitting. Boeing shall provide the Vendor glider structure drawings.

3.2.15 EJECTION RAILS. The rails shall be located within the envelope shown in Figure 1, and shall be sufficiently rigid to prevent deflection which would cause binding of the rollers (or slide blocks which may be used in lieu of rollers) or allow the rollers to jump the rails.

3.2.16 EJECTION ROLLERS OR SLIDE BLOCKS. The centerline of the ejection rollers or slide blocks shall be at 13 degrees aft of the vertical as shown in Figure 1. Maximum guided travel of the seat in the rails shall be provided.

3.2.17 HANDLING SUPPORT FITTINGS. Ground support handling fittings shall be provided on the seat structure which will allow ground maintenance personnel the provision for ease of installing and removing the seat.

3.2.18 RESCUE AND SURVIVAL KIT CONTAINER ASSEMBLY. An existing USAF qualified survival container complete with pilot and parachute cushions, bailout oxygen bottle, regulator, gauge and hose connections shall be provided for life raft and survival gear stowage. The survival gear will be selected to fit a particular mission but will at no time exceed the allocation of 40 pounds for container, cushions, location aids, life raft, and survival gear. The survival kit will be designed such that upon ejection, it shall remain attached to the parachute until the pilot pulls the disconnect handle during descent. After the handle has actuated the releases, further pull shall release the top of the container and inflate the life raft. The container and the life raft shall fall away from the pilot, both remaining attached to the drop line. The drop line can then be detached by the pilot.

3.2.19 ROCKET AND CATAPULT ASSEMBLY. A qualified rocket catapult assembly shall be integrated with the ejection seat and survival system configuration as shown in Figure 1. It shall be capable of ejecting the seat/man/survival system package to meet the performance requirements as listed in paragraph 3.4.

3.2.20 PARACHUTE ASSEMBLY. A qualified back type parachute shall be provided. This parachute shall be of the B-5 type (or equivalent) with modified attachments to conform with the full pressure - body restraint suit and shall be integrated with the ejection seat and survival system configuration as shown in Figure 1. It shall provide automatic deployment after seat man separation at ejections of 14,000 feet altitude or less, and will allow free fall to 14,000 feet before automatic deployment for higher altitudes of escape.

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 16

3.3 EJECTION SEAT AND SURVIVAL SYSTEM CONSTRUCTION

3.3.1 STRENGTH REQUIREMENTS. All ultimate loads specified in the following sub paragraphs are 1 1/2 times the proof loads and are based on the following weights:

	<u>Ejected Package</u>	<u>Non-Ejected Hdwr</u>
Weight of pilot	176 lbs	
Weight of parachute pack	1	
Weight of packed survival kit & location aids	40 lbs	
Weight of ejection seat	1	
Weight of rails		1
Weight of rocket catapult	1	1
Weight of Full Pressure Body - Restraint Suit System, Fitting and emergency oxygen	32.5 lbs	

1 Weights to be submitted by ejection seat Vendor.

3.3.1.1 PERSONNEL CATAPULT LOAD. The ejection seat and survival system shall withstand an ultimate load of 1 1/2 times the maximum catapult thrust applied downward parallel to the centerline of the rollers or slide blocks and through the combined center of gravity of the seat occupant with the seat adjusted to the most structurally critical position. In determining the combined center of gravity, the center of gravity of the seat occupant may be considered as being 11 inches forward (measured parallel to the seat bucket bottom) and 9 inches above (measured parallel to the seat back) the seat reference point. See Figure 1. The load shall be distributed over the seat bottom.

3.3.1.2 EJECTION AIR LOAD. The ejection seat and survival system shall withstand an ultimate ejection air load of 1 1/2 times the force imposed upon the seat and its occupant, created by the wind blast from ejection at a "q" of 900 pounds per square foot dynamic pressure. This force shall be applied normal to the centerline of the rollers or slide blocks and through the combined center of pressure of the exposed portion of the seat and its occupant, distributed over that portion of the seat back exposed to the air stream. For application of this load, the seat shall be positioned with the minimum amount of controlled engagement with the fixed rails. The ejection air load shall be applied simultaneously with a personnel catapult load applied as noted in paragraph 3.3.1.1. The top glider contour in the region of the seat rails is shown in Figure 1.

3.3.1.3 BOOST LOADS. The ejection seat and survival system shall withstand a 9.75 "g" ultimate load applied aft, parallel to the longitudinal centerline of the glider. This load shall be applied with the seat back tilted 8° forward (of vertical). The seat shall be adjusted to its maximum vertical position for the application of this load.

3.3.1.4 FRONT EDGE OF SEAT BUCKET. The seat shall withstand a load of 400 pounds ultimate, applied downward to the top front edge of the seat bottom over a length extending 1 1/2 inches to each side of the center of the seat, with the seat bottom horizontal.

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 17

3.3.1.5 EJECTION CONTROL. The ejection control shall be capable of withstanding a load of 500 pounds ultimate, applied at the center of the gripping surface. This load shall be applied in the direction of normal actuation.

3.3.1.6 HEAD REST. The head rest shall withstand a load of 500 pounds ultimate, applied aft in a direction parallel to the seat bottom.

3.3.1.7 RELEASE FASTENERS.

3.3.1.7.1 HIP RELEASE FASTENERS. Each hip release fastener shall withstand an ultimate load of 4125 pounds.

3.3.1.7.2 SHOULDER RELEASE FASTENERS. Each shoulder release fastener shall withstand an ultimate load of 2575 pounds or the resultant of a total ultimate load of 5150 pounds for shoulder restraint.

3.3.2 CRASH LOADS. All ultimate loads specified in the following sub paragraphs are 1 1/2 times the proof load and are based on the weights specified in paragraph 3.3.1.

3.3.2.1 FORWARD. The ejection seat and survival system shall withstand 40 "g" ultimate load applied forward parallel to the longitudinal centerline of the glider. The seat shall be in the most structurally critical position of adjustment.

3.3.2.2 SIDE. The ejection seat and survival system shall withstand a 40 "g" ultimate load applied 20° to either side of the forward direction. This results in a 37.6 "g" ultimate forward load and a 13.7 "g" ultimate side load.

3.3.2.3 DOWNWARD. The ejection seat and survival system shall withstand a 20 "g" ultimate load applied downward normal to the longitudinal centerline of the glider. The seat shall be adjusted to the most structurally critical position of adjustment.

3.4 SYSTEM PERFORMANCE

3.4.1 EJECTION SEAT. The ejection seat shall perform satisfactorily within the altitude velocity pressure limits prescribed in the escape envelope shown in Figure 3. Mach 0.9, or a velocity equivalent to a dynamic pressure of 900 psf, has been set as the upper velocity limit. It is possible that a system meeting the low altitude requirements can exceed the Mach 0.9 limit at higher altitudes. The specified upper limits of operation will be expanded accordingly, if design analysis so justifies. At the low velocity end of the envelope, a zero speed capability is desirable and has been established as a design objective. The specific low speed design requirements have been established as 70 knots equivalent air speed at zero altitude.

Seat ejection trajectory shall provide a minimum of three feet of clearance from the interference path of the B-52 carrier aircraft wing, for the performance conditions shown in Figure 4. This requirement will satisfy clearance requirements for the glider flying alone. Glider to B-52 dimensional relationship is shown in Figure 5. Clearance of the B-52 tail in the side view is not required, since the maximum yaw angle of the B-52 does not result in a collision path of the seat and tail.

DYNA-SOAR EJECTION SEAT AND SURVIVAL SYSTEM	BOEING AIRPLANE COMPANY	10-81000
		P NO. 18

3.4.1 CONTINUED

For ground level ejection within the velocity limits specified, the trajectory shall provide sufficient altitude and/or duration for complete parachute deployment and inflation to insure pilot safety. Figure 6, 6a, and 6b show calculated approximate ground level ejection trajectories without parachute deployment. Stability of seat/man combination during ejection shall be such that neither the seat/man separation, nor parachute deployment is compromised.

The seat/man/catapult combination shall be so designed that ejection, within the limits of the escape envelope, shall not produce resultant damaging accelerations on the pilot.

3.4.2 ENVIRONMENTAL REQUIREMENTS. The design of the ejection seat and survival system shall be adequate to obtain the desired performance characteristics and service life under the following environmental conditions:

3.4.2.1 TEMPERATURE AND ALTITUDE. The ejection seat and survival system shall be designed to operate satisfactorily through an ambient temperature range of -65°F to 160°F , and from an altitude of sea level to 94,500 feet.

3.4.2.2 VIBRATION AND DYNAMIC REQUIREMENTS. The system components shall protect the pilot from injury when subjected to the vibrations and dynamic loads encountered in the Dyna-Soar mission, as well as those encountered during ejection and seat/man separation. The vibration envelope for a normal mission is shown in Figure 7.

3.4.3 RELIABILITY. The overall system reliability objective shall be .986. This number includes the period from initiation of the ejection sequence until the parachute is deployed. The achieved reliability will be determined by analytical means utilizing data from pre-production testing in conjunction with component reliabilities established by the industry. See paragraph 4.2.3.

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81600

P NO. 19

4.0 QUALITY ASSURANCE PROVISIONS

4.1 GENERAL. Classification of tests, method of reporting tests, etc., shall be established by D2-6558, General Requirements Supplement to the Source Control Drawing for Dyna-Soar.

4.2 PREPRODUCTION TESTS. Test plans shall be prepared by the Vendor and submitted to Boeing Company for approval in accordance with Section 4 of D2-6558, and will include proposed detail test procedure and number of items to be tested.

4.2.1 DEVELOPMENTAL TESTS. The Vendor shall conduct the necessary developmental tests to ascertain the design of a subsystem compatible with the Dyna-Soar requirement as delineated in Section 3 and the selection of components suitable to the Dyna-Soar environment. Prototype subsystems shall be made available to the buyer for simultaneous developmental testing involving glider interface system development.

4.2.1.1 ZERO VELOCITY INVESTIGATION. This developmental test program will include investigations of ejection performance at zero velocity in accordance with the design objective stated in paragraph 3.4.1.

4.2.2 STRUCTURAL TESTS. One seat, representative of a production seat, shall be mounted on the ejection rails and a test jig by the fittings to be used for installation. The seat shall then be subjected to, and be required to withstand without failure, the ultimate loads specified in Section 3.

4.2.3 RELIABILITY TESTING. Specific reliability testing will not be required. The test results of all preproduction testing will be analyzed in conjunction with established component reliabilities to determine the anticipated level of system reliability achieved. These analysis results, together with the raw data utilized, will be submitted to The Boeing Company for approval.

4.3 ACCEPTANCE TESTS. The Vendor shall conduct all acceptance tests according to an acceptance test plan provided by the Vendor and approved by Boeing. Acceptance tests shall be consistent with Boeing Document DL-8000.

4.3.1 FUNCTIONAL TESTS. Functional tests shall be conducted by the Vendor to assure compliance with the functional requirements of Section 3.

4.3.2 COMPONENT TESTS. Where practical, components of the ejection seat may be tested separately to determine their compliance with the functional requirements of Section 3.

4.3.3 ENVIRONMENTAL TESTS. One test article shall be subjected to environmental tests required to assure compliance with the environmental requirements of Section 3.4.2. The test article shall demonstrate functional capabilities after exposure to environmental tests. Environmental testing may be conducted by components where practical. These tests should be fashioned after those established in MIL-E-5272C (ASG) dated April 1959, where applicable.

4.4 BOEING RECEIVING INSPECTION AND FUNCTIONAL TESTS. Boeing will establish receiving inspection and functional tests pursuant to paragraph 4.1.3 of D2-6558.

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 20

4.5 SLED TESTS. The Vendor shall conduct dynamic sled tests of the ejection seat at the Edwards Air Force Base Track Facility. These tests will be conducted under the cognizance of, and with the support of Boeing. Initial arrangements, negotiations and scheduling with the Air Force for the use of the track facility will be Boeing responsibility. Overall operation and maintenance of the test program shall be Vendor responsibility, except as qualified herein. The actual sled runs, instrumentation and operation will be conducted by Air Force track personnel. The Vendor will not be responsible for the successful operation and qualification of the cockpit hatch and jettison system, but will be responsible for the sequence system up to the jettison thrusters.

The jettisonable windshield heat shield will be tested and qualified in this sled test program, but it is not part of the seat ejection system nor is it functionally related. The heat shield will be furnished by Boeing, and the Vendor is not responsible for its test qualification. The heat shield will be tested on ejection seat runs, but separately from the escape system. Separate sled runs for the heat shield are not to be included in the Vendor's sled test plan.

The full body pressure suit and integrated restraint system will also be finally qualified in this sled test program. The pressure suit is G.F.E. and the Vendor will not be responsible for its availability or performance, other than its integration with the seat assembly.

The ejection seat sled tests shall be programmed to provide necessary developmental testing of the seat ejection subsystem, including interface equipment, culminating in qualification of the production ejection seat subsystem.

4.5.1 Satisfactory system performance shall be demonstrated at velocities of approximately 70, 400, and 510 knots at sea level. Sequencing of the window heat shield release will be timed so as not to jeopardize successful operation of the ejection systems. Zero velocity capability will be evaluated during the developmental test program, paragraph 4.2.1.1.

4.5.2 The seat shall withstand the ejection loads and demonstrate satisfactory performance as specified in section 3.3 and 3.4.

4.5.3 A glider section and sled assembly will be provided by The Boeing Company. This glider section will include all glider/ejection system interfaces, production quality hatch and hatch jettisoning system, window heat shield and jettisoning system, and accommodations for instrumentation to be mounted in the glider section.

4.5.4 The ejection seat interface equipment supplied by Boeing will consist of the escape hatch jettisoning mechanism, hatch release interlock system, pilot suit, and the pilot suit service umbilical connections.

4.5.5 The Vendor shall supply the necessary quantities of ejection seat and survival systems described in this document, and anthropomorphic dummy to support these tests. The anthropomorphic dummy shall be of a 75th percentile in accordance with WADC Technical Report No. 52-321, dated September 1954.

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 21

4.5.6 The anthropomorphic dummy shall be instrumented to measure acceleration forces throughout the ejection, seat separation, and descent sequences.

4.5.7 The Vendor shall prepare detail recommended test plans for this series of sled tests and submit to Boeing for approval.

5.0 PREPARATION FOR DELIVERY

5.1 PREPARATION FOR DELIVERY. Packaging and marking of the article procured by this drawing shall be in accordance with the provisions of D2-6558, General Requirements Supplement to the Source Control Drawing for Dyna-Soar.

6.0 NOTES.

6.1 EJECTION SEAT INTERFACE. Boeing shall provide ejection seat interface design information and conduct all necessary liaison with the Vendor to accomplish interface design. Interface design includes pressure - restraint suit, suit service connections from the glider, escape hatch actuation, and glider structural attachment.

22
DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 22

HATCH OPENING & SYMA

HATCH ENVELOPE 35.48

FLIGHT CONTROLLER
ABORT HANDLE

FORWARD INSTRUMENT PANEL
ENERGY MANAGEMENT DISPLAY

W.L. 123.75
(REF)

RUDDER POSITION
(NEUTRAL)

EJECTION CONTROL

RESCUE &
SURVIVAL KIT

L.H. SIDE VIEW

1

STA
270.0
(REF)

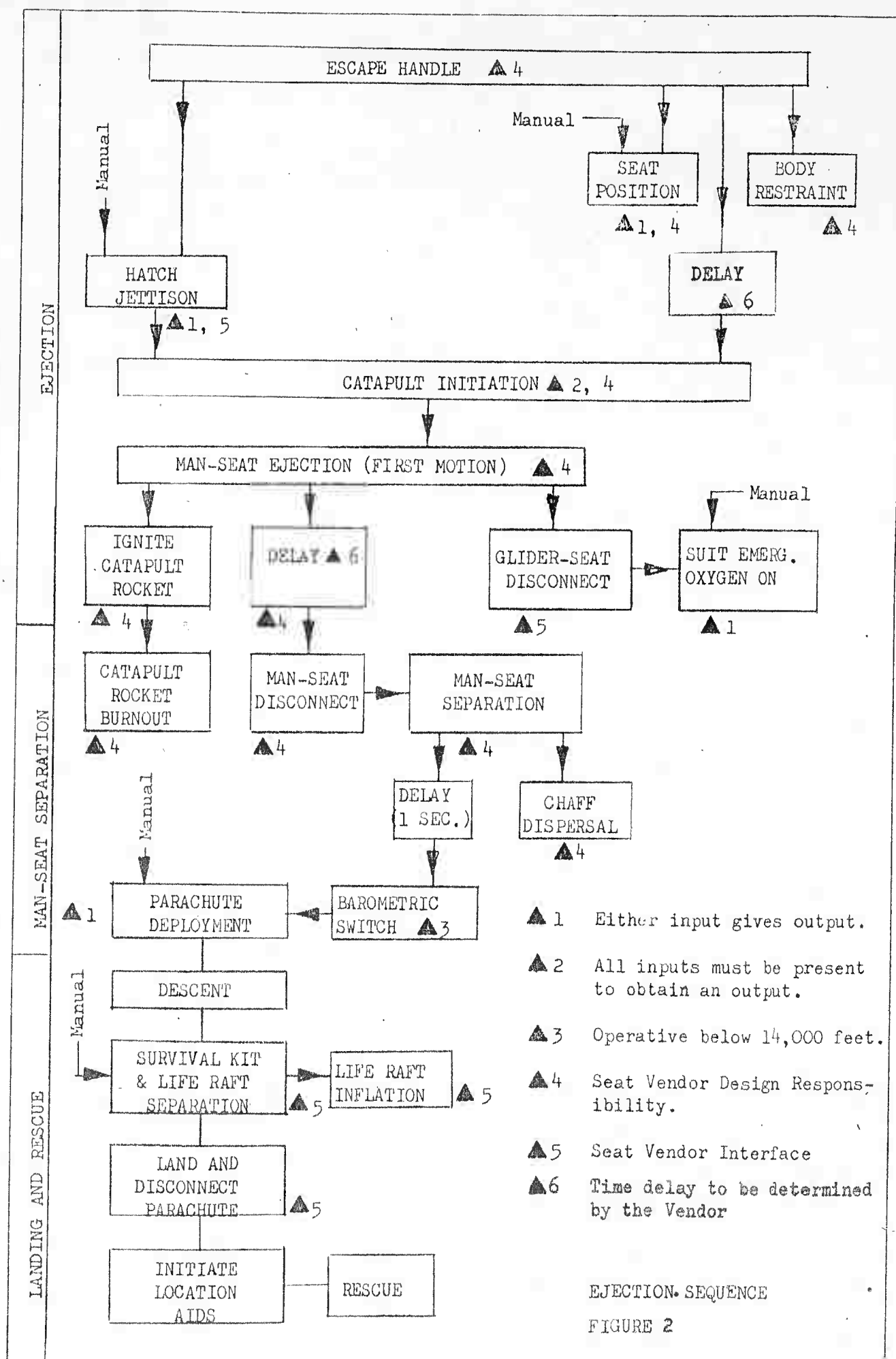
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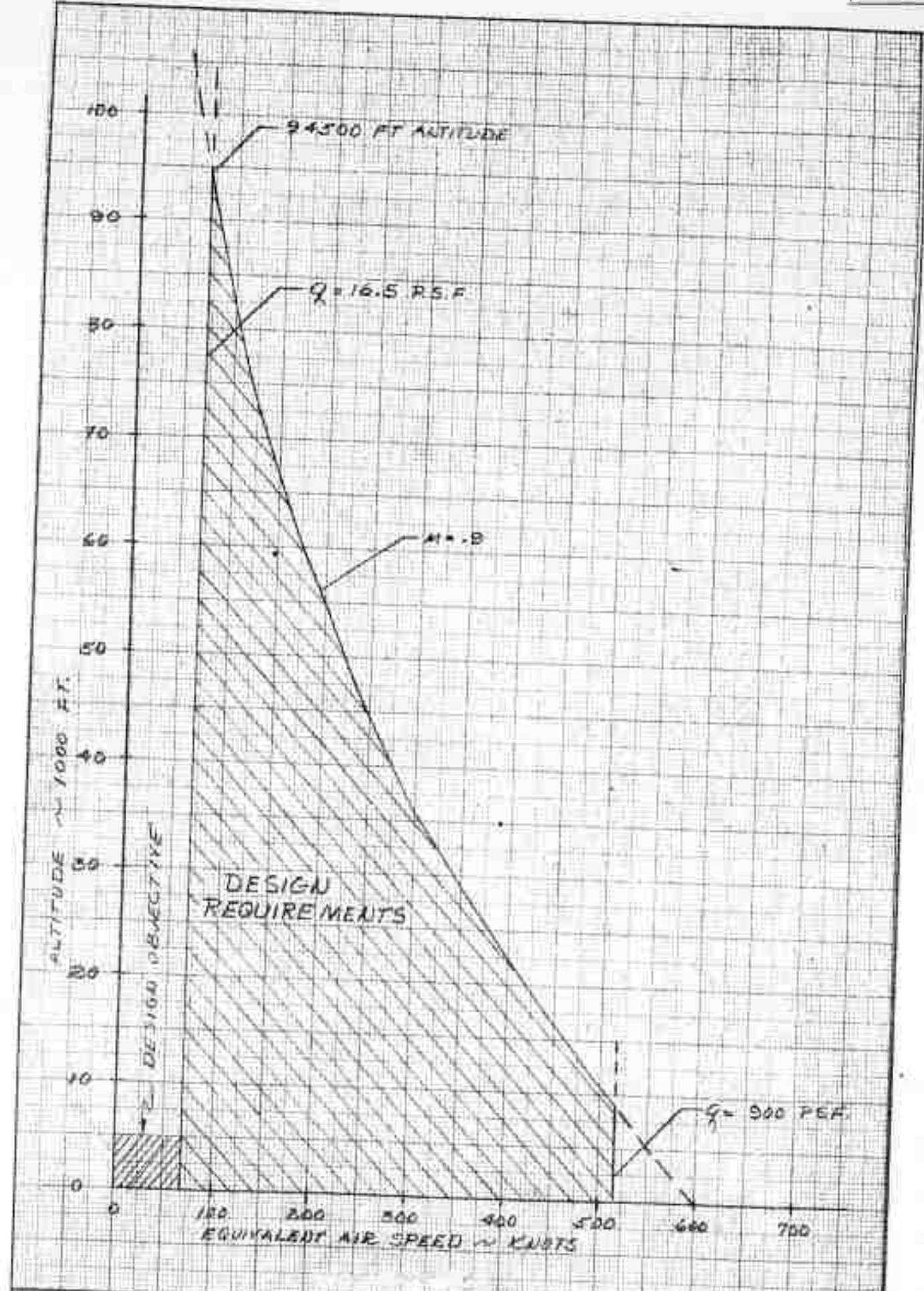
SEAT
(75)

3



BUFILE NO. 100-81000
PAGE 23





CALC			REVISED	DATE	DYNA SOAR ESCAPE ENVELOPE	FIG 3
CHECK						10-81000
APP						PAGE
APP						25
BOEING AIRPLANE COMPANY						

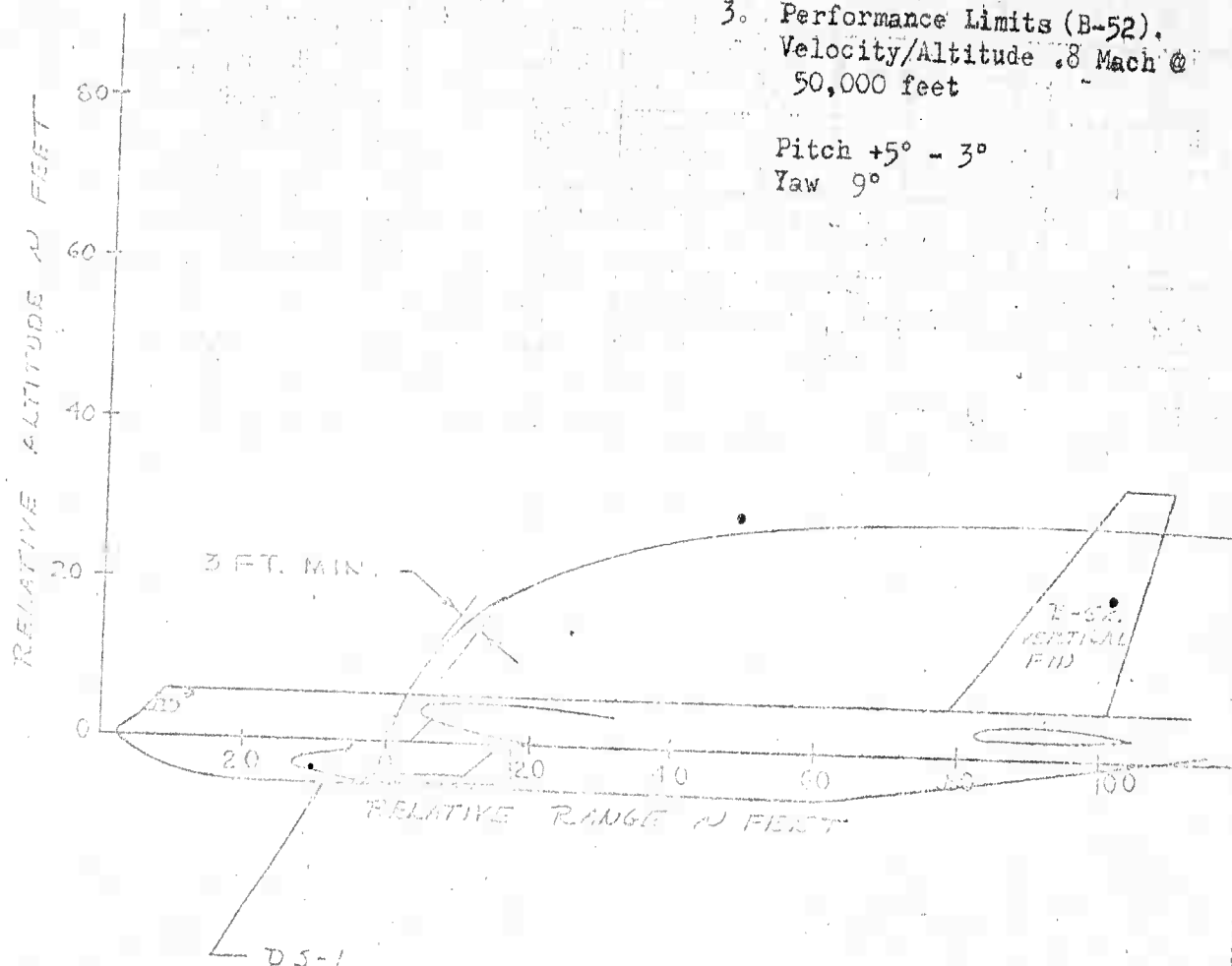
BAC 461 C-R4

25

NOTE:

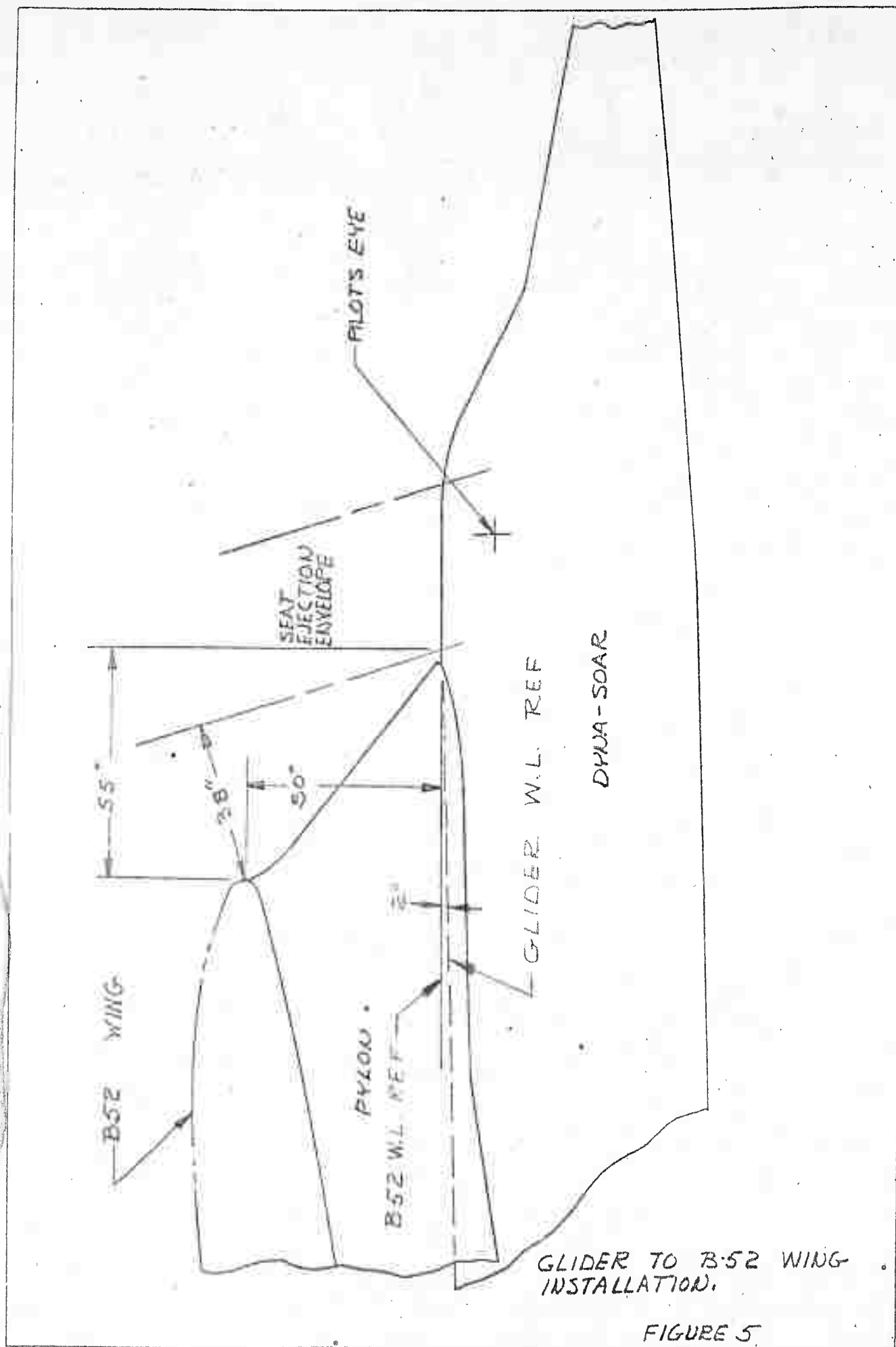
1. Distance Measured from rear of Glider Escape Hatch.
2. Trajectory appears as it would to an observer riding in the parent vehicle (B-52).
3. Performance Limits (B-52).
Velocity/Altitude .8 Mach @ 50,000 feet

Pitch $+5^{\circ} - 3^{\circ}$
Yaw 9°



CALC			REVISED	DATE	CLEARANCE ENVELOPE REQUIREMENTS MINIMUM EJECTION TRAJECTORY	FIG 4
CHECK						
APT						10-81000
APR						
					BOEING AIRPLANE COMPANY	PAGE
						26

DAC 46PC-RA



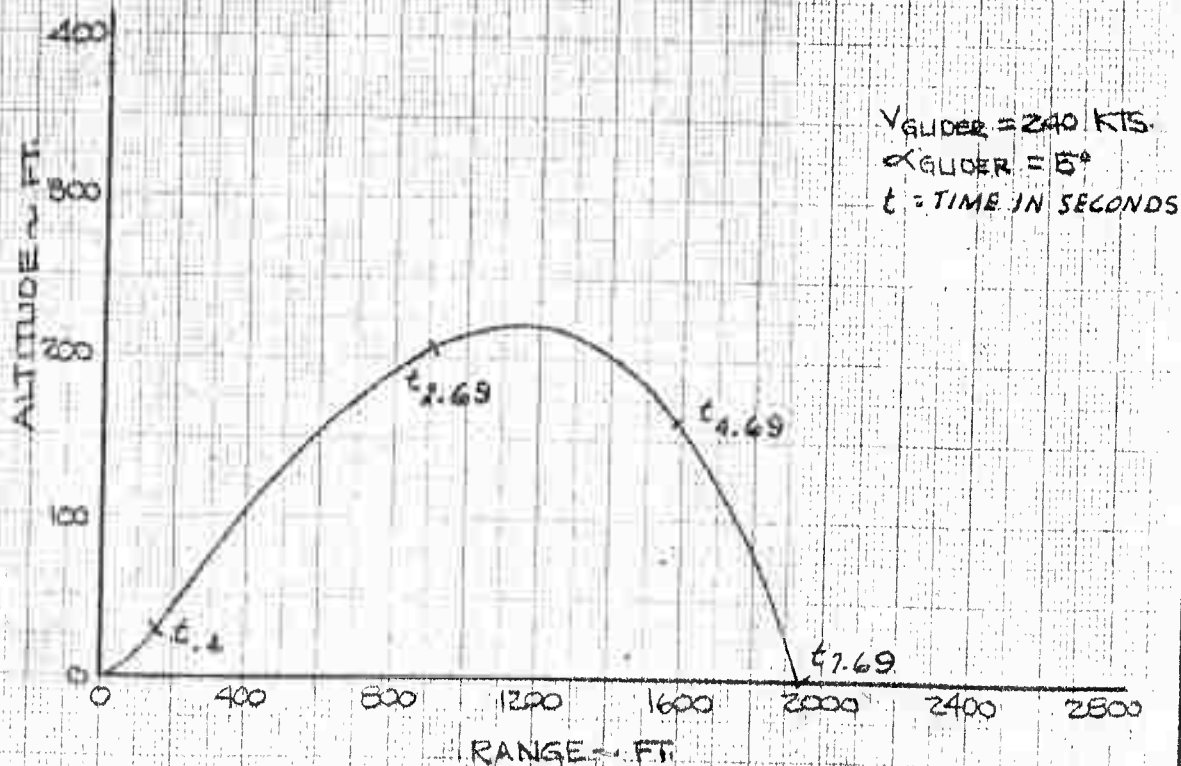
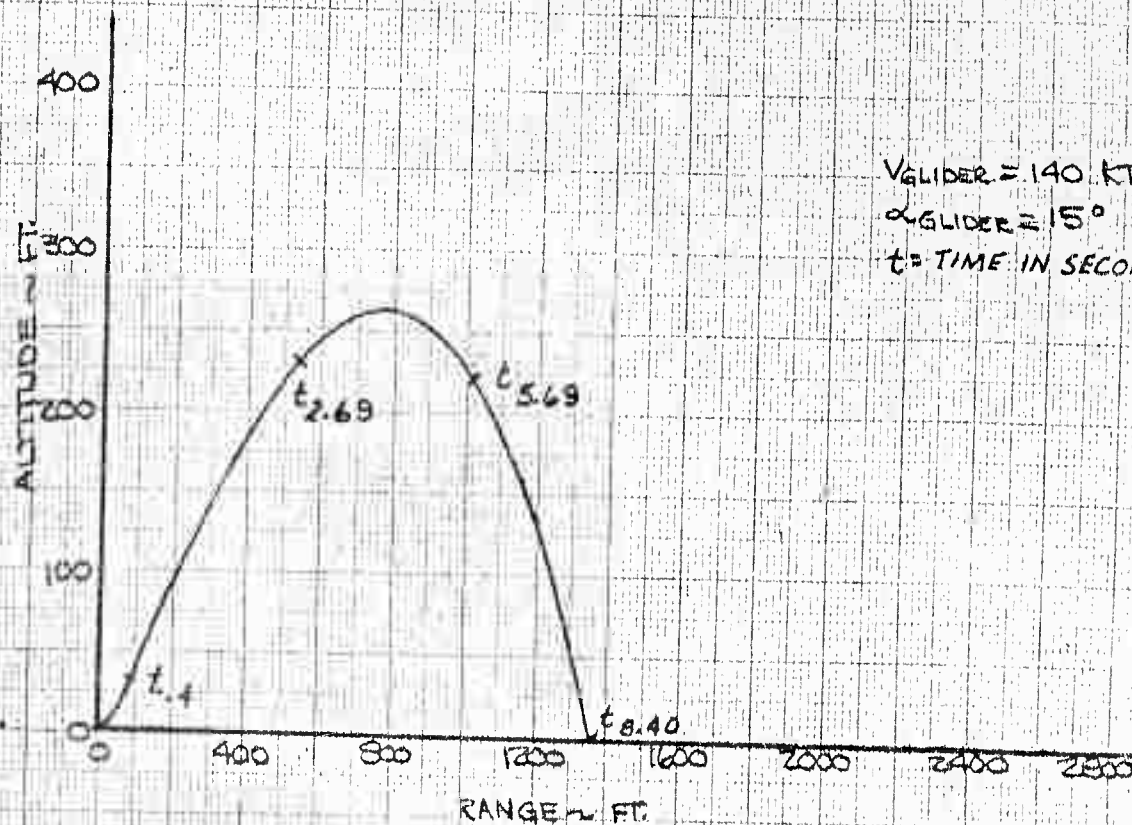
U3-4071-1000 (was BAC 1546-LR3)

BOEING

NO. 10-81000

PAGE 27



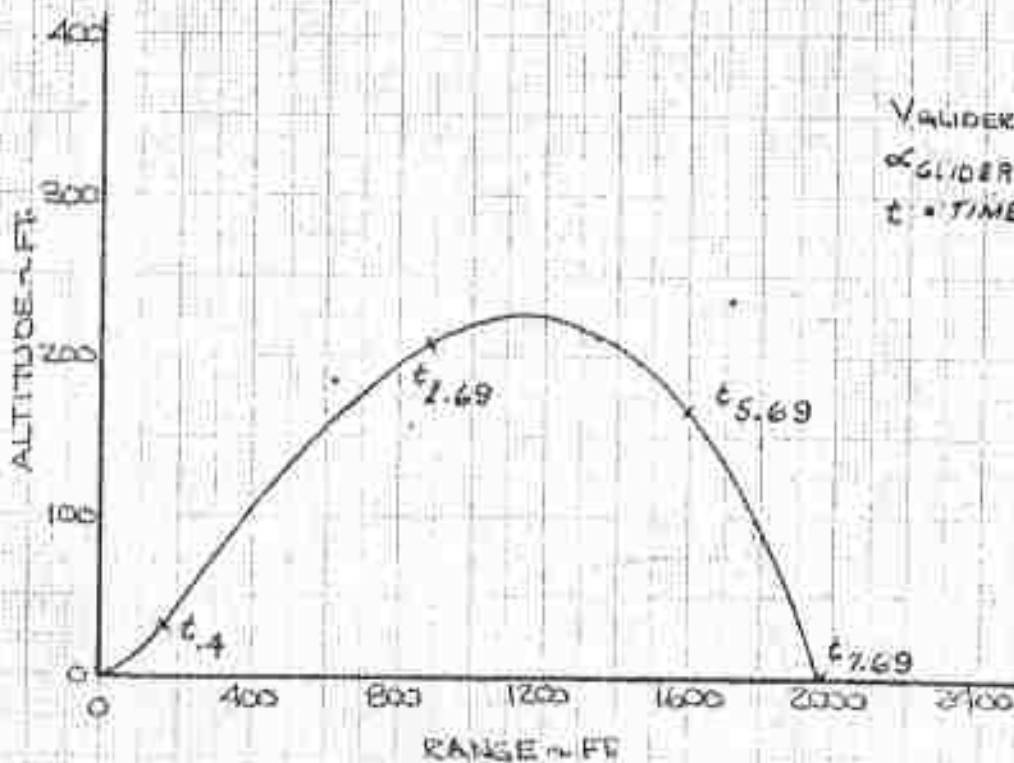
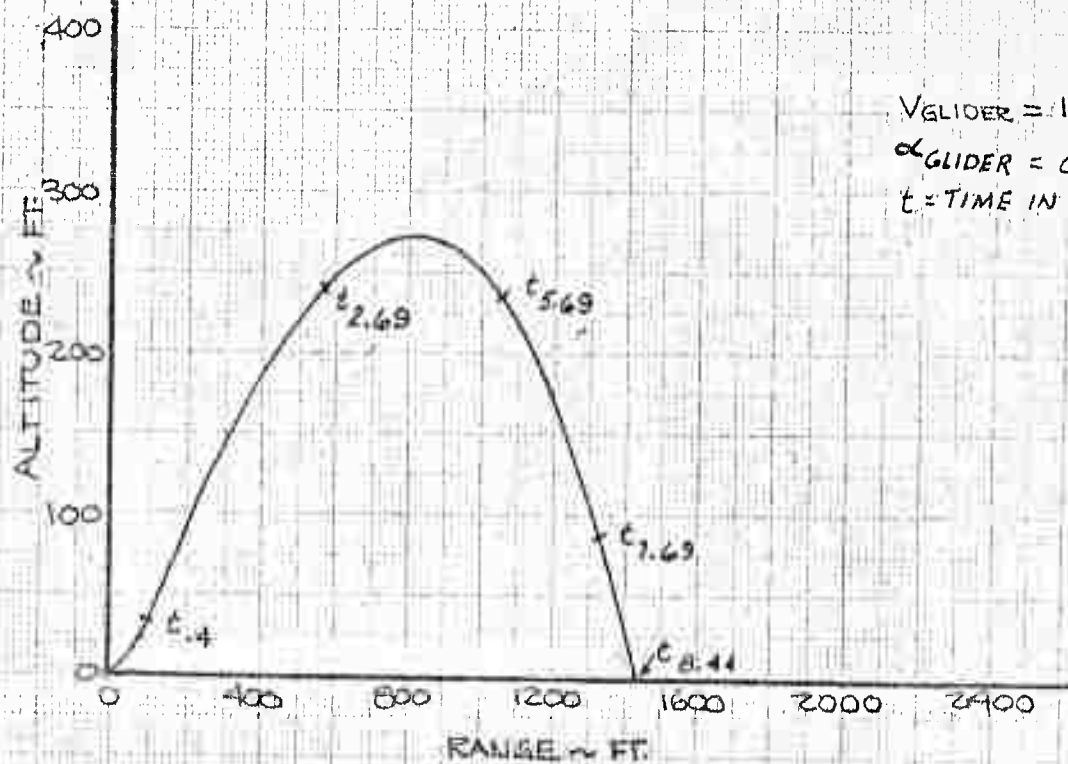


CALC		5-18-61	REVISED	DATE	SEAT/MAN EJECTION TRAJECTORIES FIGURE BOEING AIRPLANE COMPANY	FIG. 6
CHECK						10-81000
APR						PAGE 28
APR						

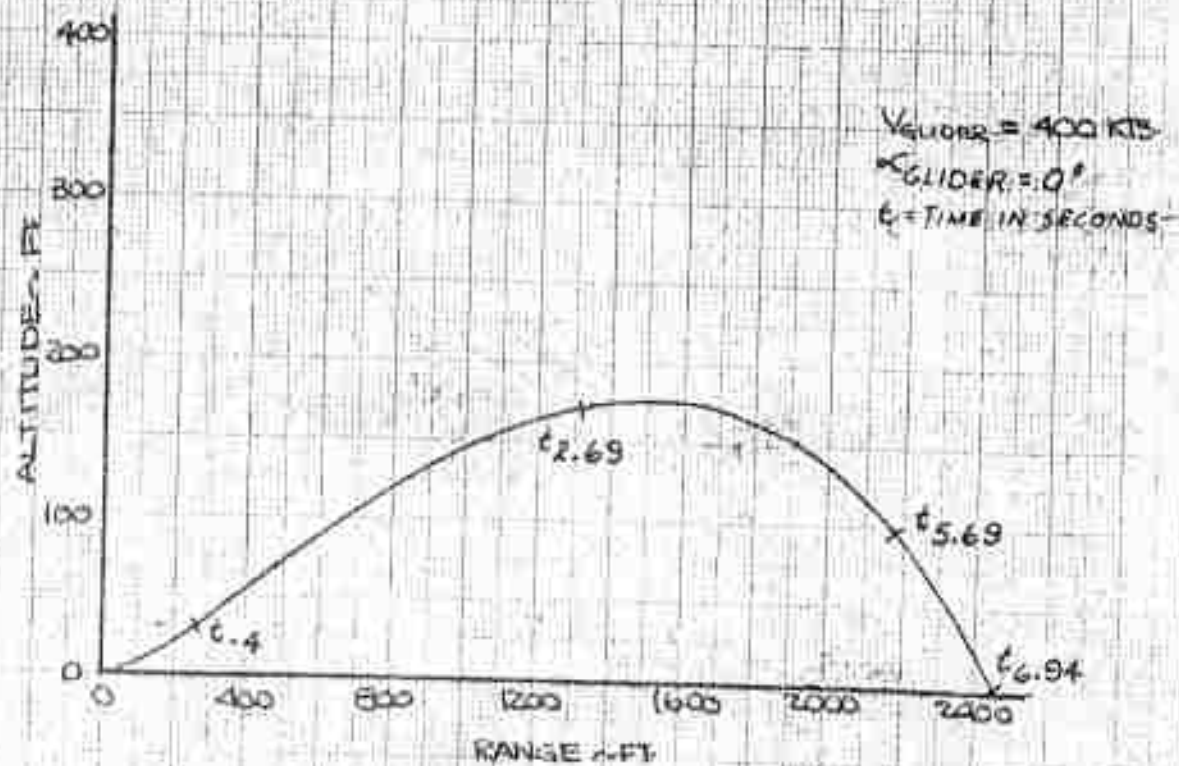
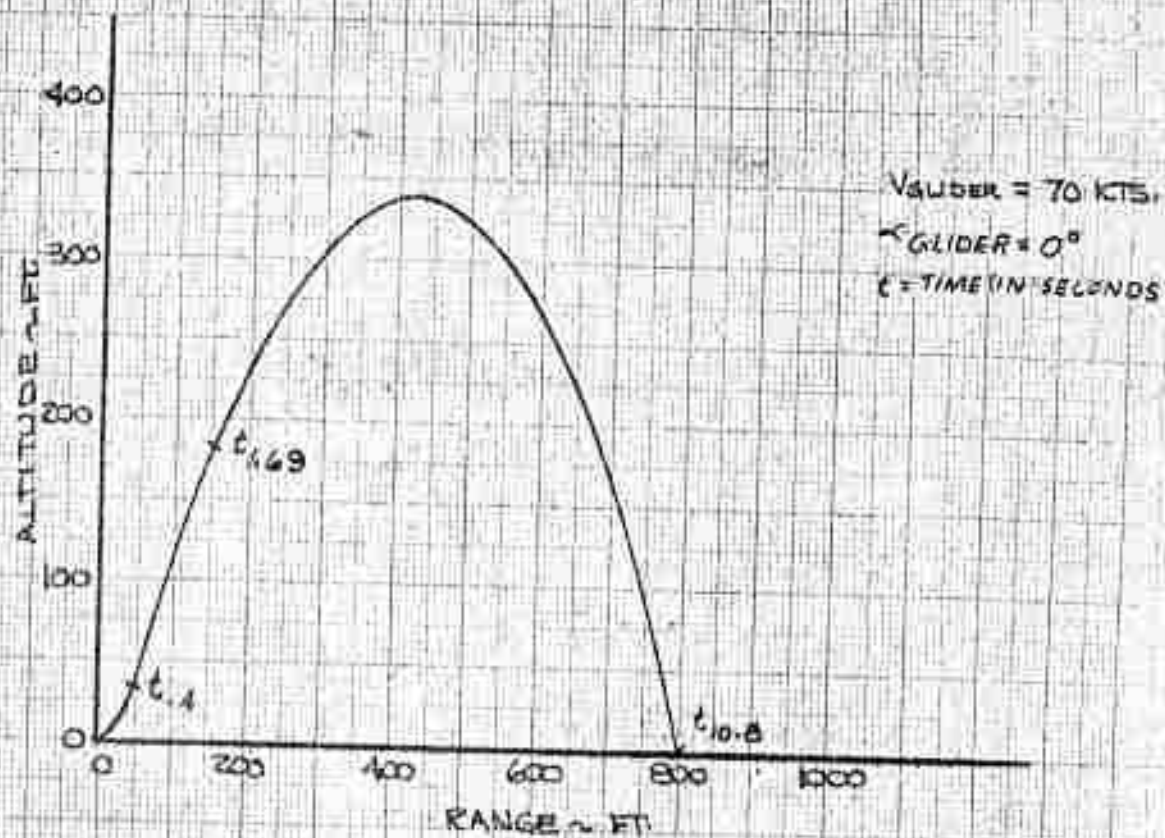
U3 4013 8000 (WAS BAC 461 C-R4)

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CALC		5-19-61	REVISED	DATE	SEAT/MAN EJECTION TRAJECTORIES FIGURE BOEING AIRPLANE COMPANY	FIG. 6a
CHECK						10-51000
APP						PAGE
APP						29



CALC		5-64	REVISED	DATE	SEAT/MAN EJECTION TRAJECTORIES FIGURE BOEING AIRPLANE COMPANY	FIG. 6b
CHKD						10-51000
APP						PAGE 30
APP						

U3 4013 B000 1045 RAC 407 C-41

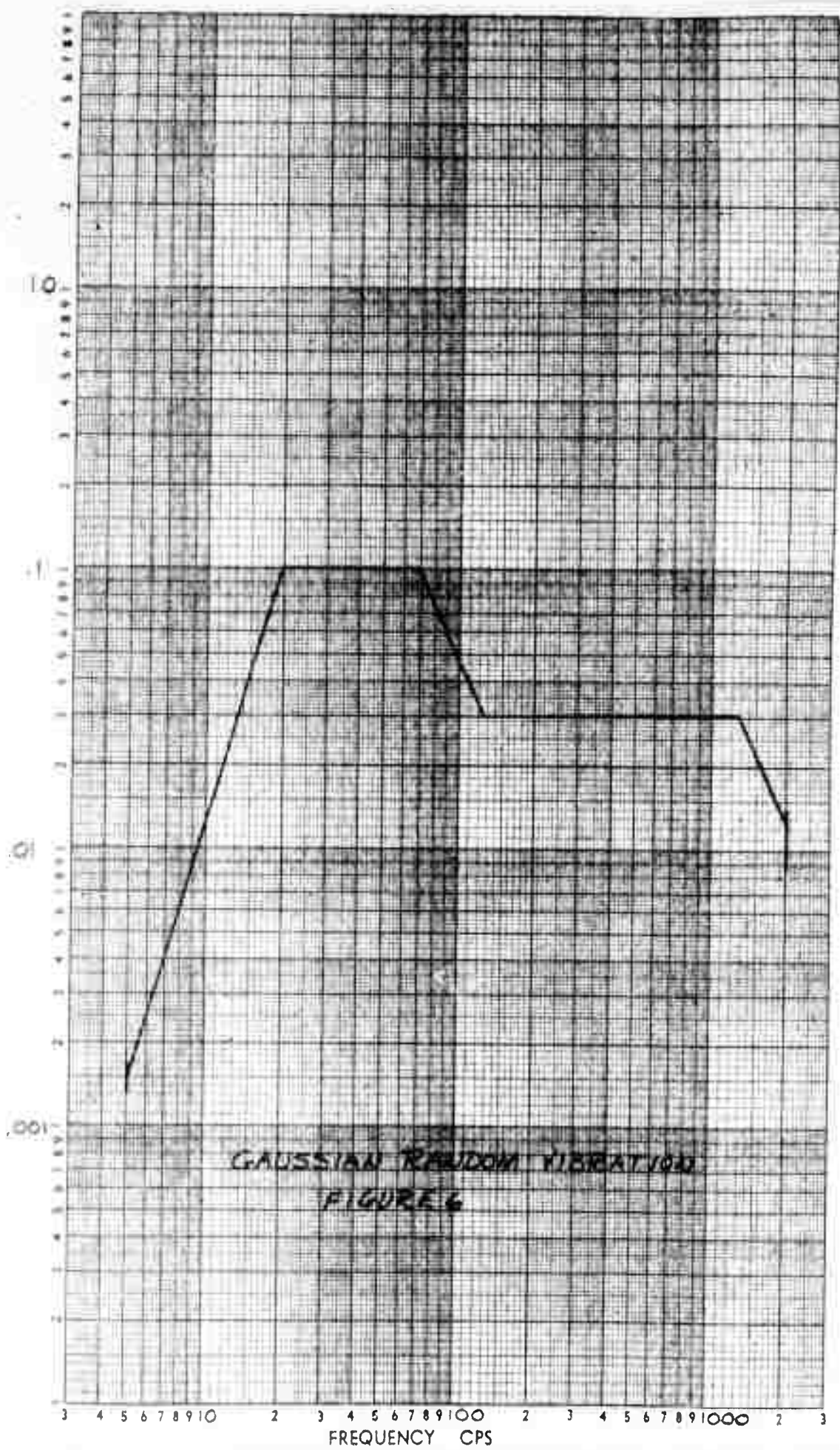
CHANNEL NO.

GROUP NO.

CONDITION NO.

TEST NO.

ACCELERATION POWER SPECTRAL DENSITY G CPS



CALC		REVISED	DATE	VIBRATION ENVIRONMENTAL REQUIREMENTS	FIG. 7
CHECK					10-81000
APPR					PAGE 31
APPR					
				BOEING AIRPLANE COMPANY SEATTLE 24, WASHINGTON	

APPENDIX A

DEVIATIONS TO MIL-S-9479
SEAT, UPWARD EJECTION, AIRCRAFT

The following deviations to MIL-S-9479, Seat: Upward Ejection, Aircraft, dated 19 March, 1954, will be effective for the Dyna-Soar Subsonic Ejection Seat.

Paragraph 3.3.1 defines the dimensional requirements for the ejection seat.

Deviation: The revised dimensional requirements are reflected in Figure 1, Page 22, of this drawing.

Reason: Revision of dimensional requirements is necessary to reflect changes in pilot size requirements, the two-position seat concept and unique Dyna-Soar pilot support requirements.

Paragraph 3.3.2.1: Specifies vertical seat adjustment requirements.

Deviation: - The revised vertical seat adjustment requirements are specified in Paragraph 3.2.1.1 of this drawing.

Reason: Revision of vertical adjustment requirements is dictated by the reduction in pilot size variance for Dyna-Soar.

Paragraph 3.3.2.3 describes the vertical seat adjustment control design requirements.

Deviation: Pre-flight vertical seat adjustment control design requirements are described in Paragraph 3.2.1 of this drawing.

Reason: Elimination of in-flight adjustment and associated control handle requirement provides weight reduction and is not necessary for Dyna-Soar mission.

Paragraph 3.3.5 specifies the design of automatic opening lap safety belt attachments.

Deviation: Specification of the design of attachments for the Dyna-Soar integrated full pressure and restraint system appears in paragraph 3.2.5 of this drawing.

Reason: Dyna-Soar safety restraint is provided by an integrated full pressure and restraint suit rather than Type MA-1 Automatic Opening Lap Safety Belt.

Paragraph 3.3.6 provides for attachment of Type MB-2 shoulder harness.

Deviation: Provisions for attachment of the Dyna-Soar restraint system are made in Paragraph 3.2.5 of this drawing.

Reason: Type MB-2 shoulder harness is replaced by an integrated full pressure and restraint system.

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 32

Paragraph 3.3.7: specifies a Type MA-1 shoulder harness take-up reel and the installation thereof.

Deviation: Specification of a powered take-up reel to provide positive pilot positioning for ejection is set forth in Paragraph 3.2.6 of this drawing.

Reason: Emergency conditions may prevent the pilot from attaining ejection position without power assistance.

Paragraph 3.3.8: describes design requirements for a shoulder harness support.

Deviation: No shoulder harness support is required for Dyna-Soar.

Reason: Need for shoulder harness support is dictated by inertia reel location and, since inertia reel location is not fixed, the need for said support is not required.

Paragraph 3.3.10: Specifies head rest location and configuration for a one-position seat of 95th percentile maximum size man accommodation to be used with standard Air Force helmets.

Deviation: Paragraph 3.2.8 of this drawing specifies head rest location and configuration compatible with the two-position concept, Dyna-Soar pilot support requirements and 75th percentile maximum pilot size.

Reason: Dyna-Soar requires two-position seat to provide adequate boost acceleration tolerance, reduction in maximum pilot size to fit space limitations, and head rest configuration change to accommodate the full pressure suit helmet.

Paragraph 3.3.11: defines leg brace design requirements.

Deviation: Paragraph 3.2.9 of this drawing defines leg protection requirement.

Reason: Changes in ejection control concept frees design requirements for leg braces.

Paragraph 3.3.12 provides for the design of stowable arm rests which erect leg braces for ejection.

Deviation: Paragraph 3.2.10 of this drawing provides for pilot arm supports which will restrain the pilot's arms within the ejection envelope during ejection.

Reason: Dyna-Soar pilot support requirements and change in ejection control requires arm rest configuration change.

Paragraph 3.3.14 provides for foot stirrups as pilot foot rests.

Deviation: Foot stirrups will not be used in the Dyna-Soar.

Reason: Elimination of the foot stirrup requirement provides weight saving.

DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 33

Paragraph 3.3.16 specifies the design of emergency ejection controls located in on-the-leg braces.

Deviation: Paragraph 3.2.12.1 of this drawing specified a single ejection control located in front of the seat edge which would be between the pilot's legs.

Reason: Ejection initiation control location in the position between the pilot's legs provides the necessity of the pilot bringing his arms within the ejection envelope prior to ejection.

Paragraph 3.3.16.1 requires hand grips and triggers for ejection initiation located on the leg braces.

Deviation: Paragraph 3.2.12.1 of this drawing defines hand grips for the ejection control described in Paragraph 3.2.12.1 of this drawing.

Reason: Deviation is required to accommodate the change in ejection control configuration.

Section 3.4.3 specifies seat strength requirements.

Deviation: Section 3.3.1 of this drawing specifies seat strength requirements compatible with Dyna-Soar load expectancy.

Reason: Seat strength requirements are changed to reflect changes in maximum man size and increased loading in the Dyna-Soar mission.

28
DYNA-SOAR EJECTION SEAT AND
SURVIVAL SYSTEM

BOEING AIRPLANE COMPANY

10-81000

P NO. 31

UNCLASSIFIED

UNCLASSIFIED